

Performance and Safety of COTS 18650 Li-ion Cells from Various Manufacturers

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Outline

- Cell Characteristics
- Performance of Panasonic Cells
- Safety of Panasonic Cells
- Performance of Moli STOBA cells
- Safety of Moli STOBA cells
- Performance of LG cells at Different Temperatures

18650 Lithium-ion cells

Panasonic 3.1 Ah



LG 2.8 Ah



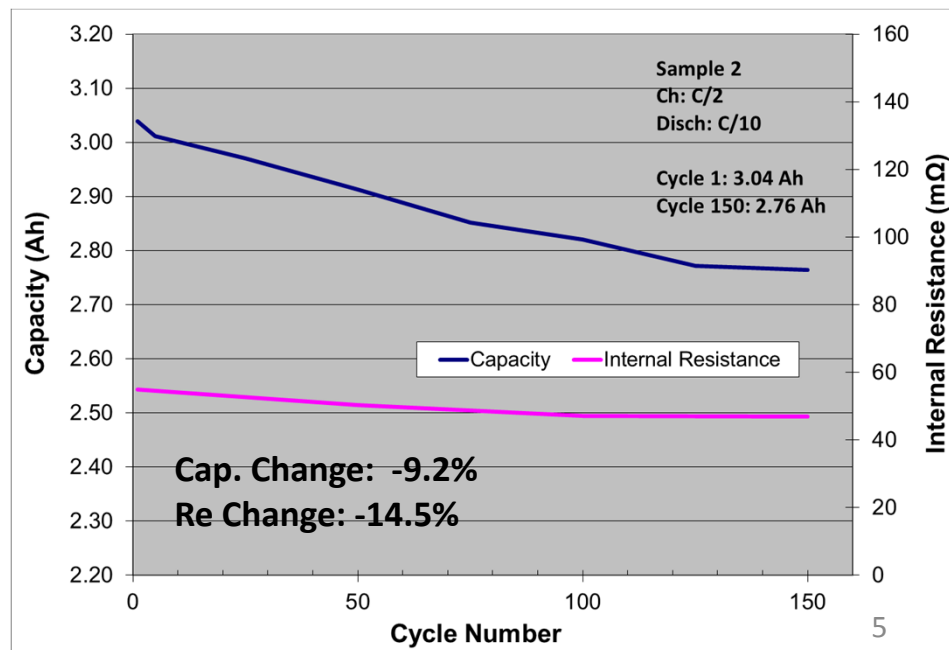
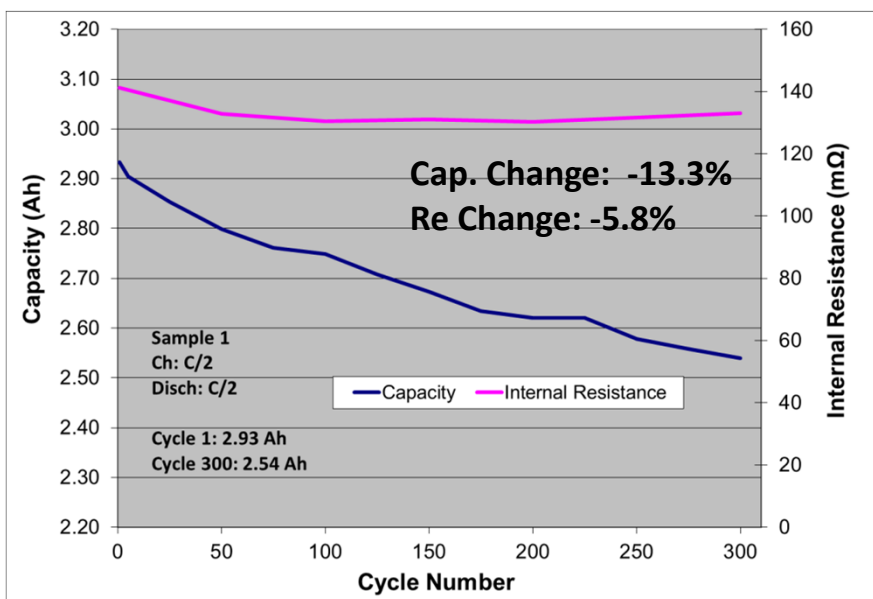
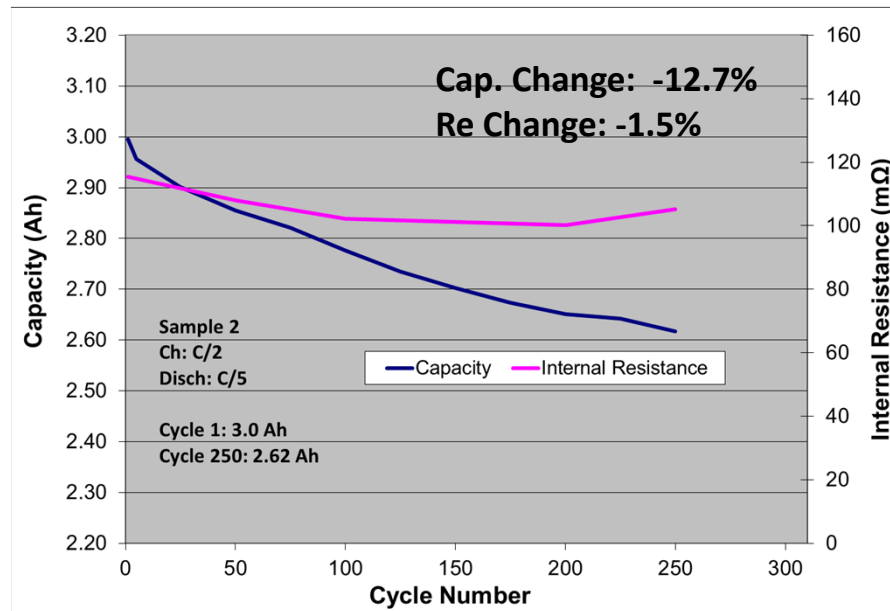
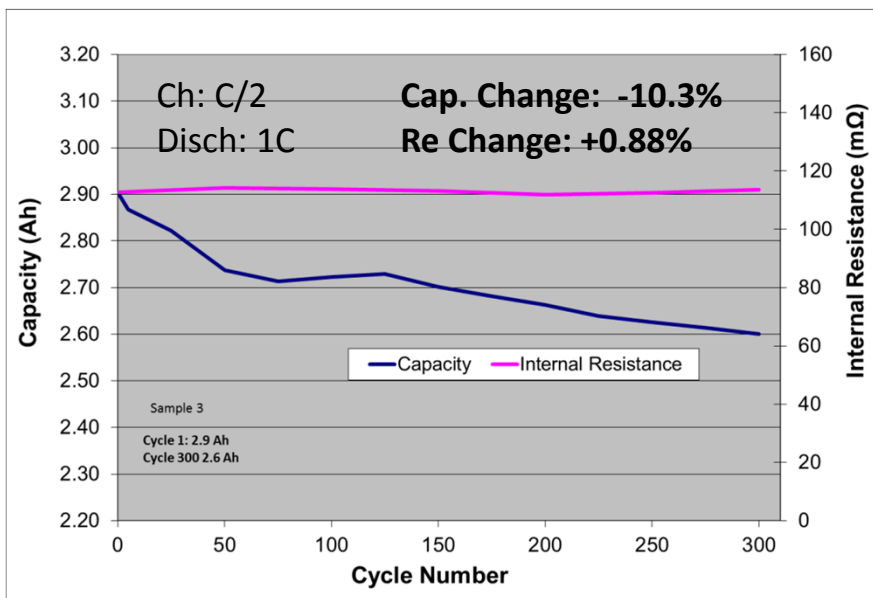
Moli STOBA 2.0 Ah



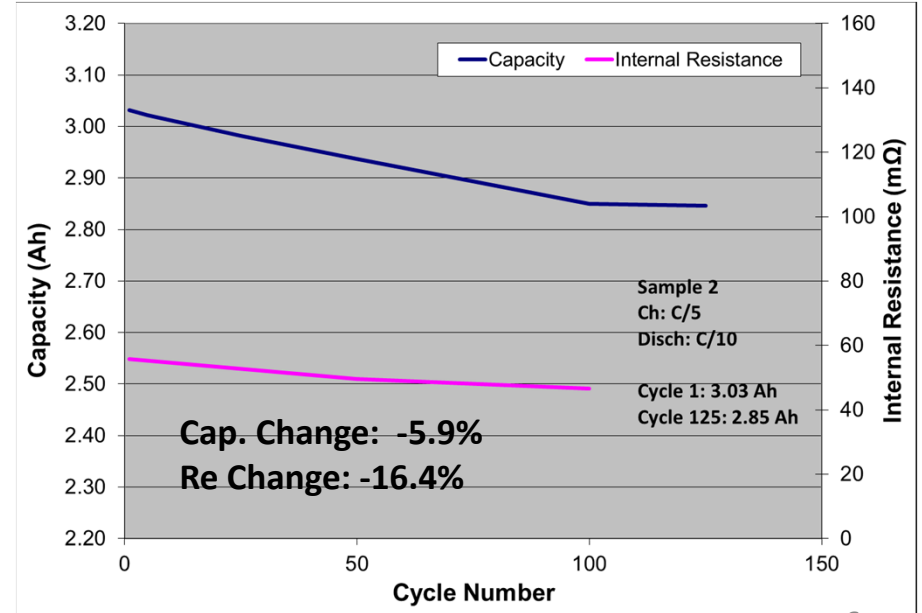
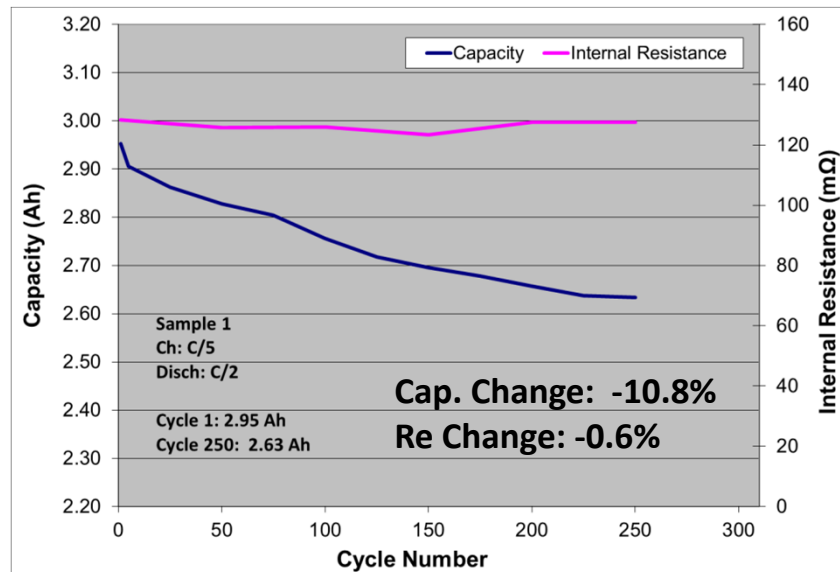
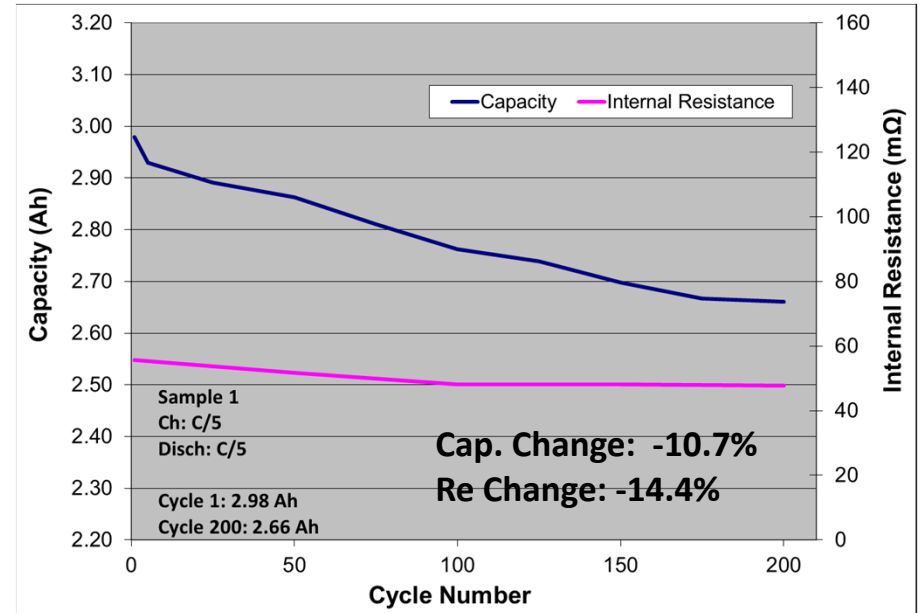
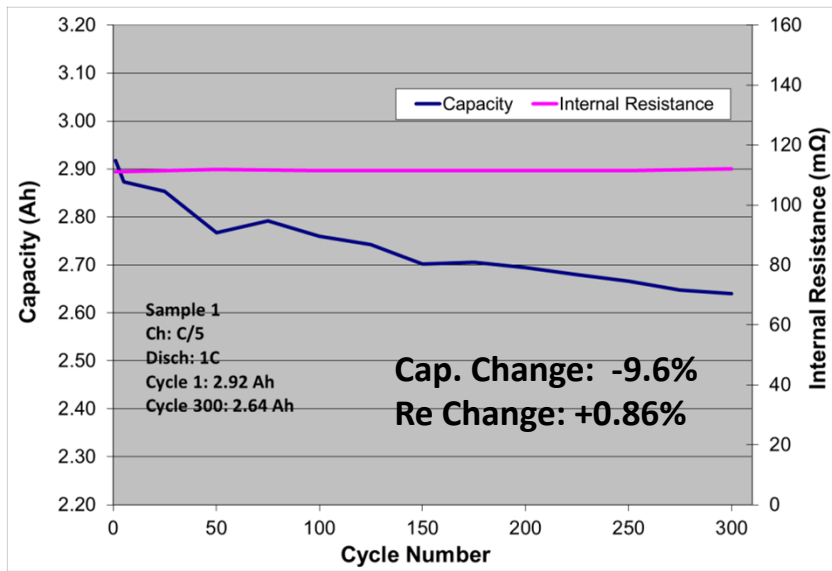
Panasonic 3.1 Ah Li-ion 18650 Cell

Performance and Safety Test Data

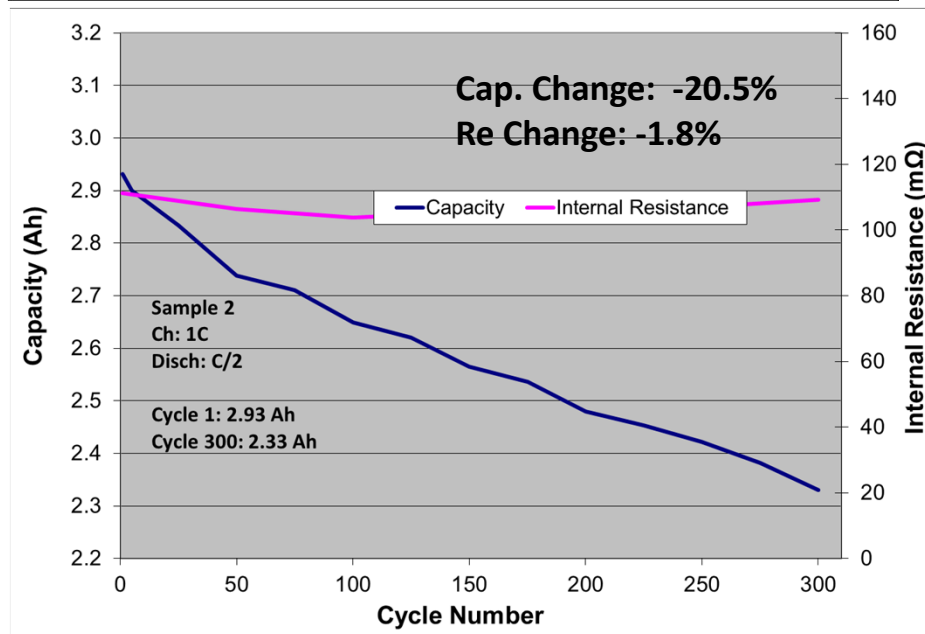
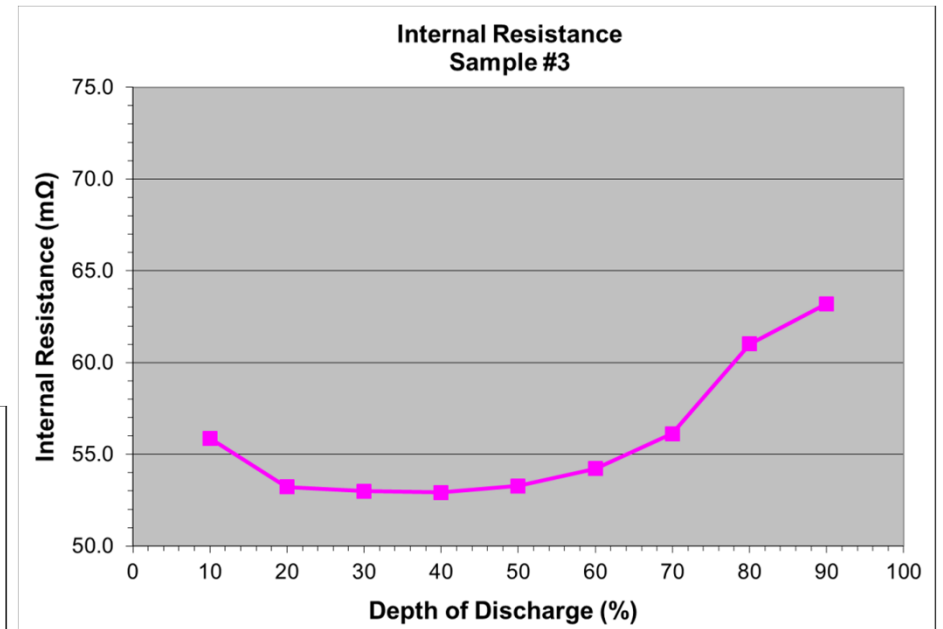
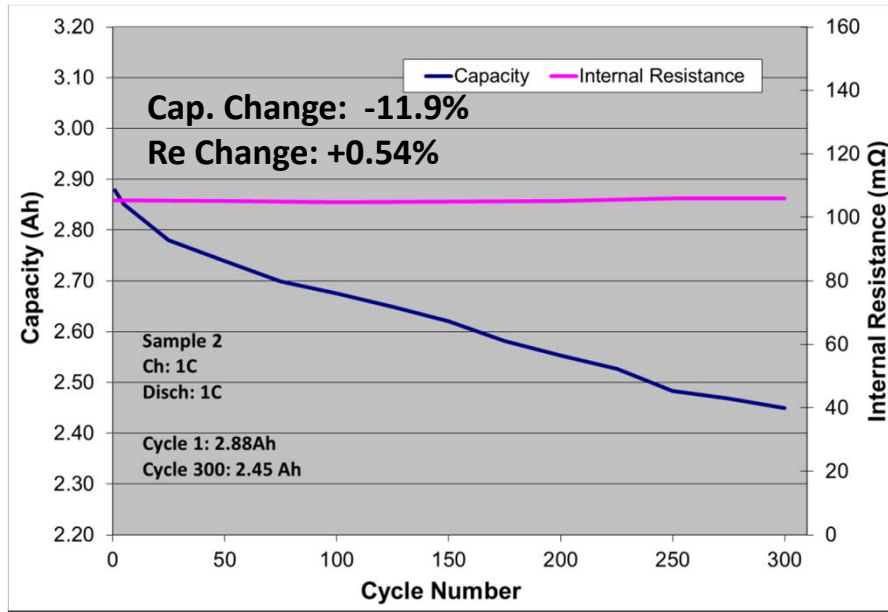
Panasonic 3.1 Ah Li-ion 18650 Cell



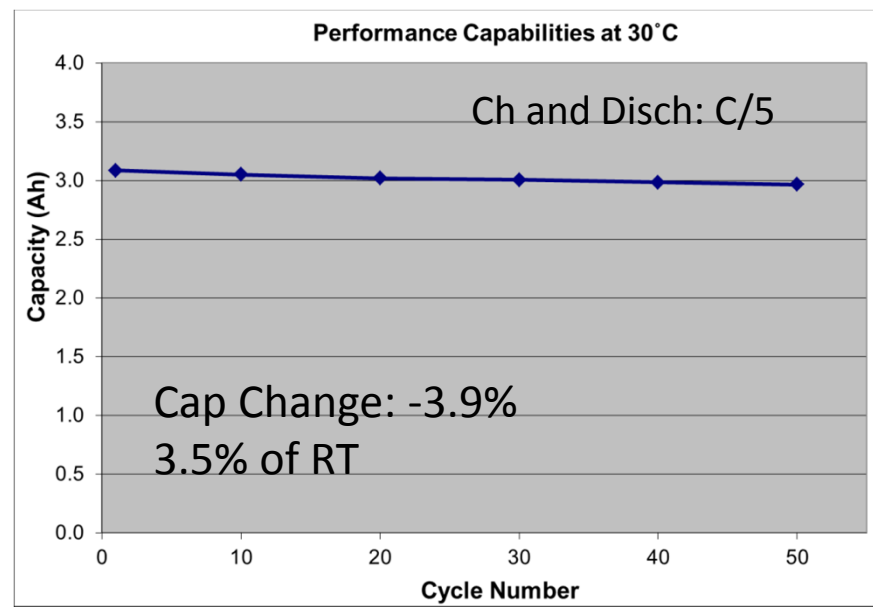
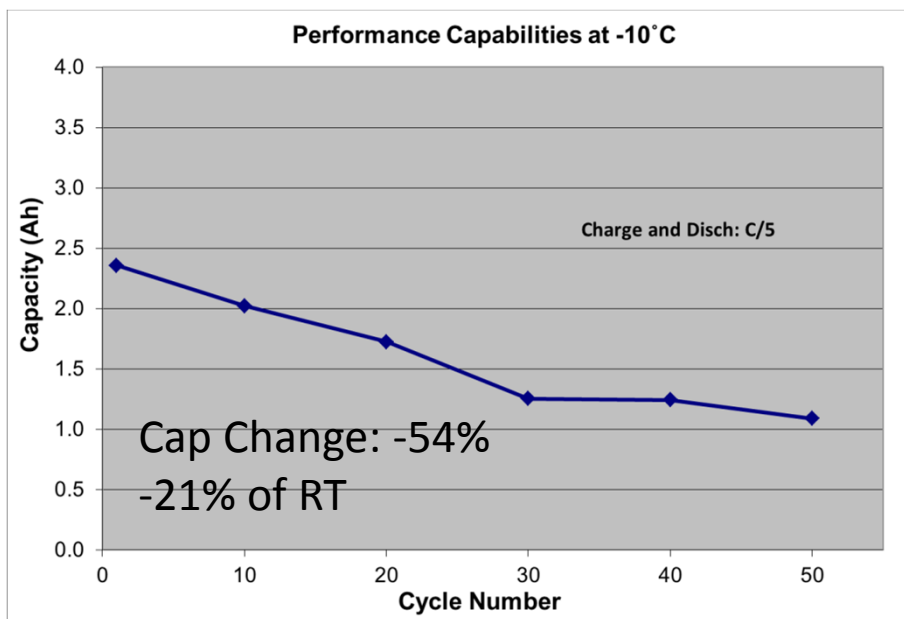
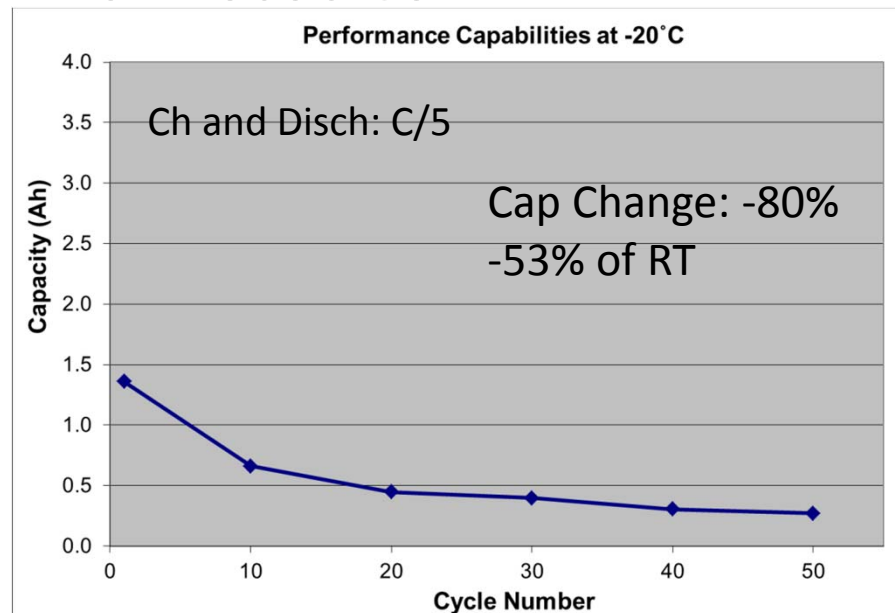
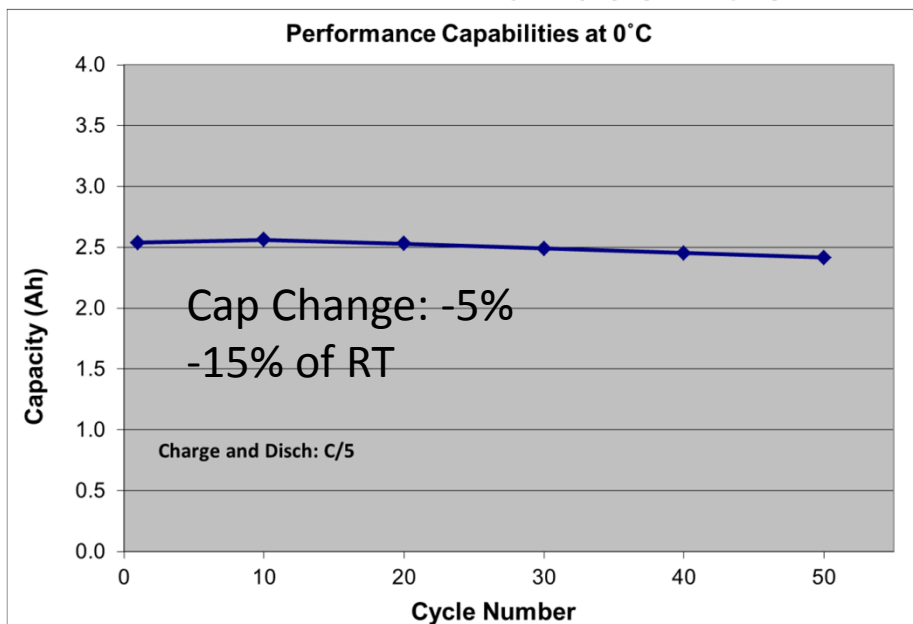
Panasonic Li-ion 3.1 Ah 18650 Cell



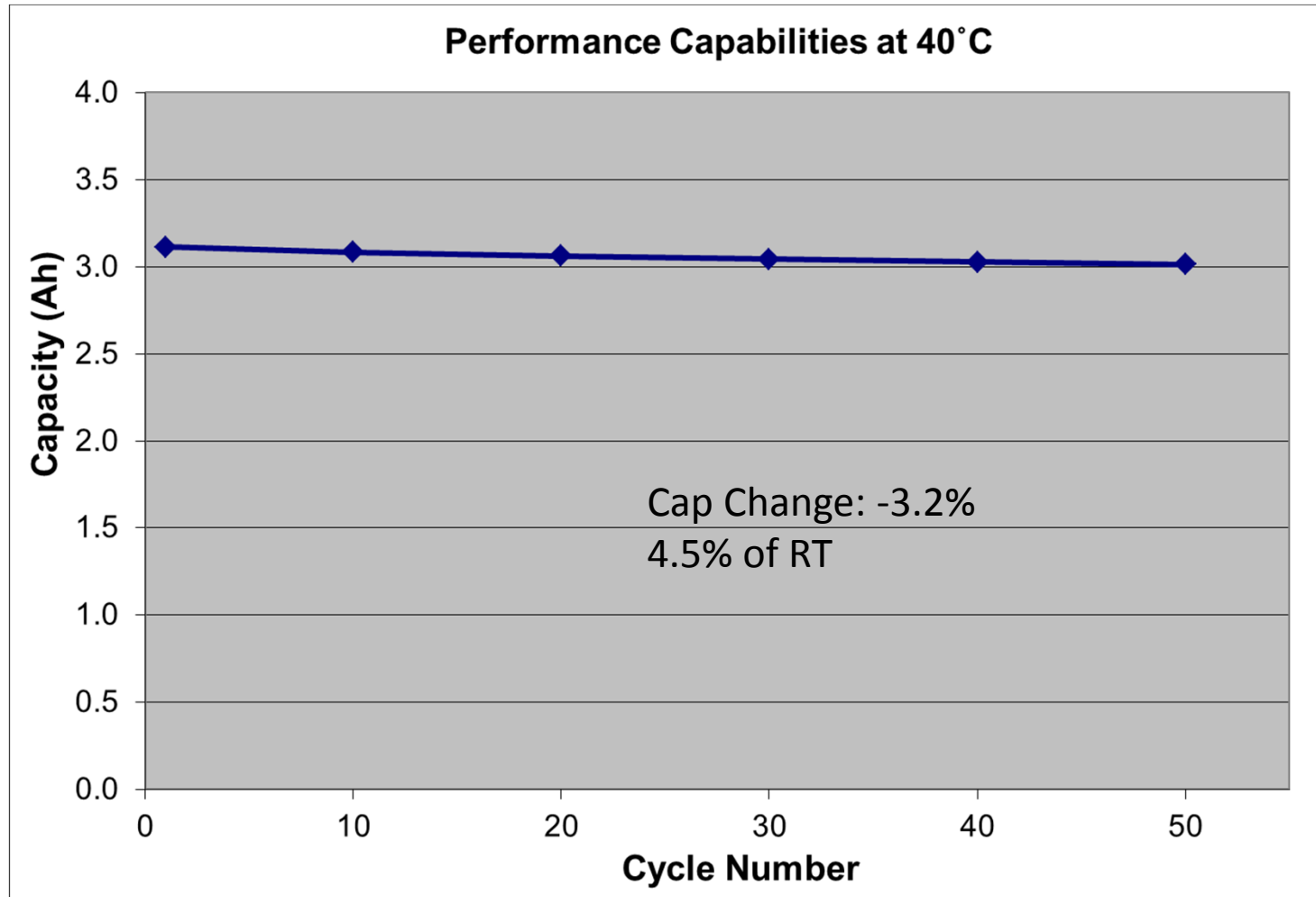
Panasonic 3.1 Ah Li-ion 18650 Cell



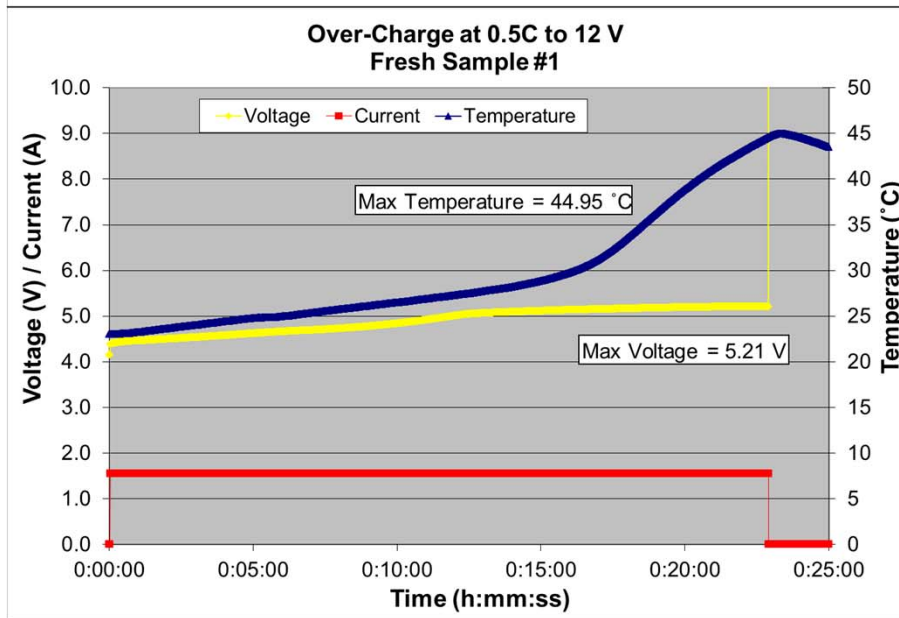
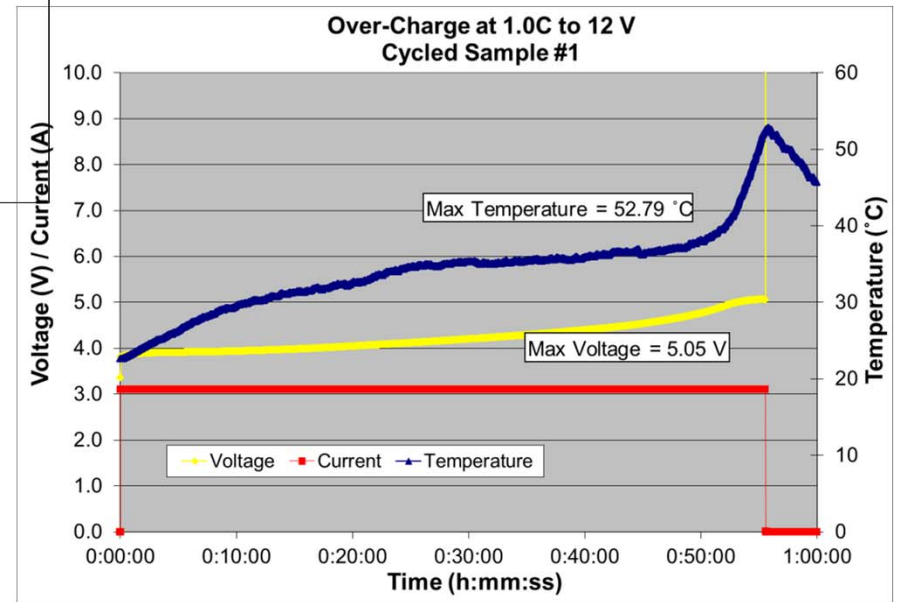
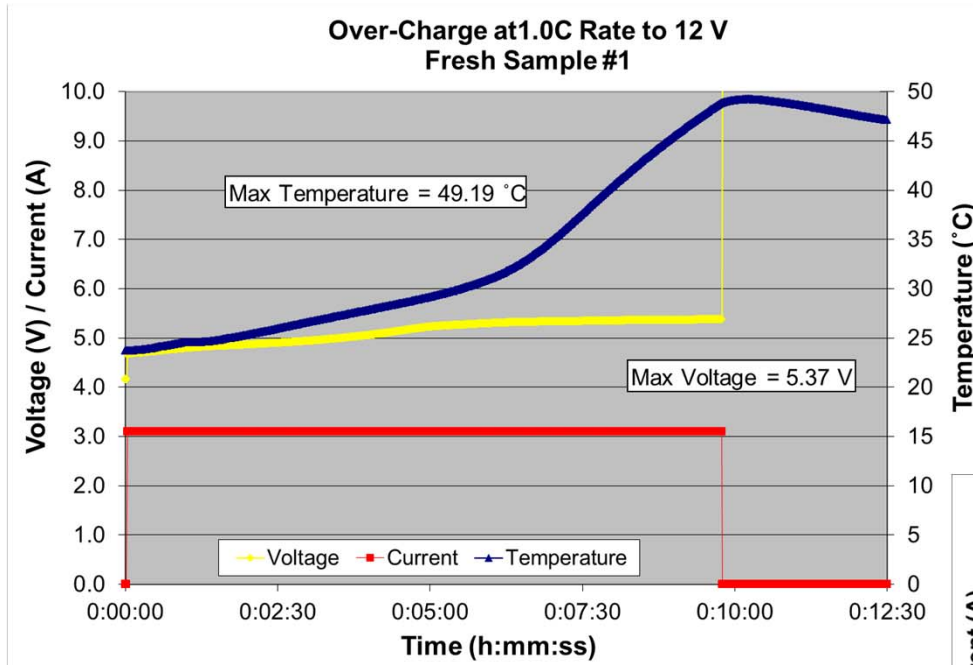
Panasonic 3.1 Ah Li-ion 18650 Cell



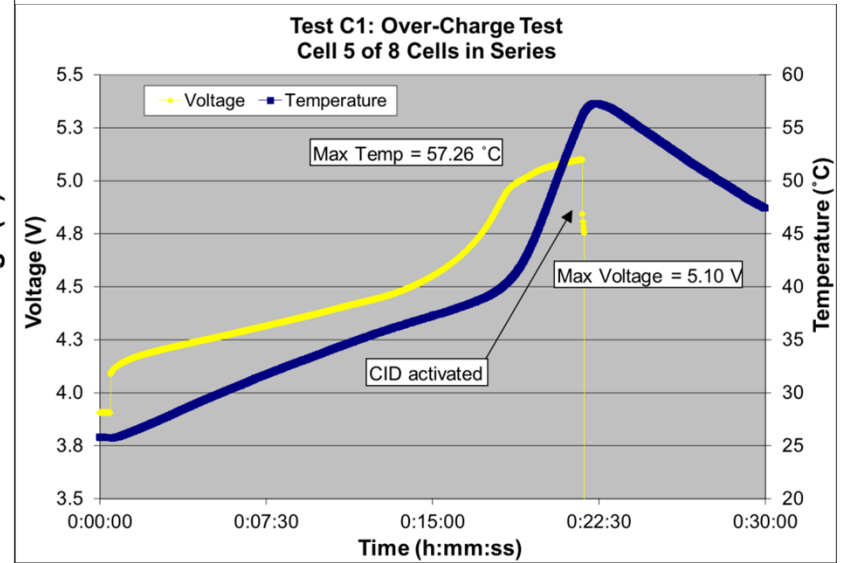
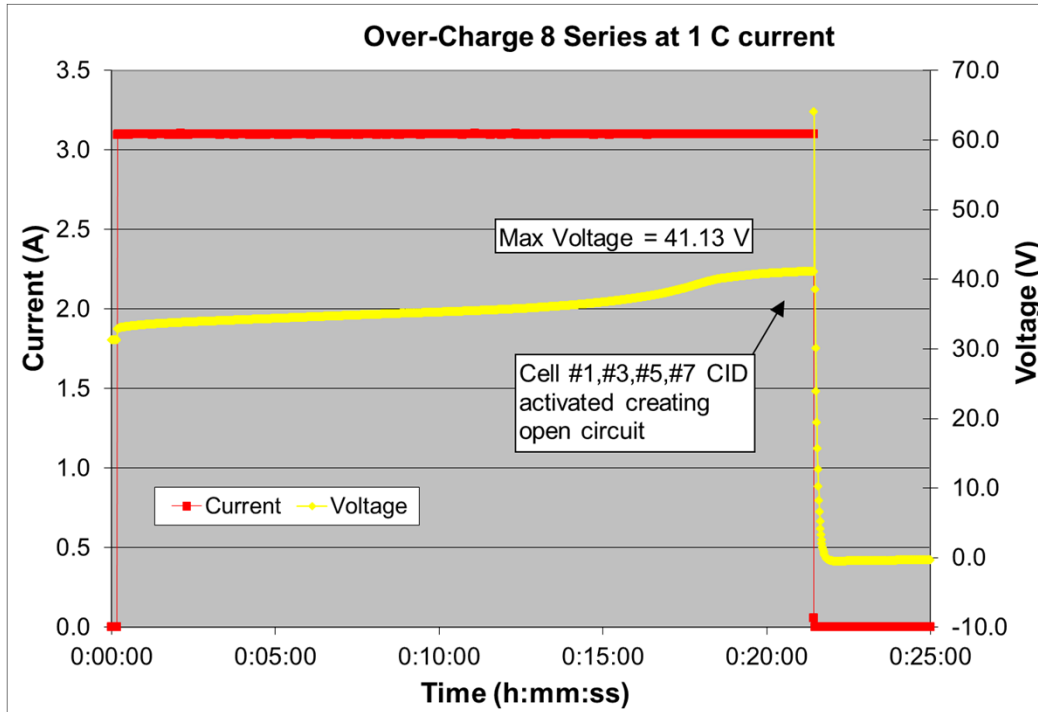
Panasonic 3.1 Ah Li-ion 18650 Cell



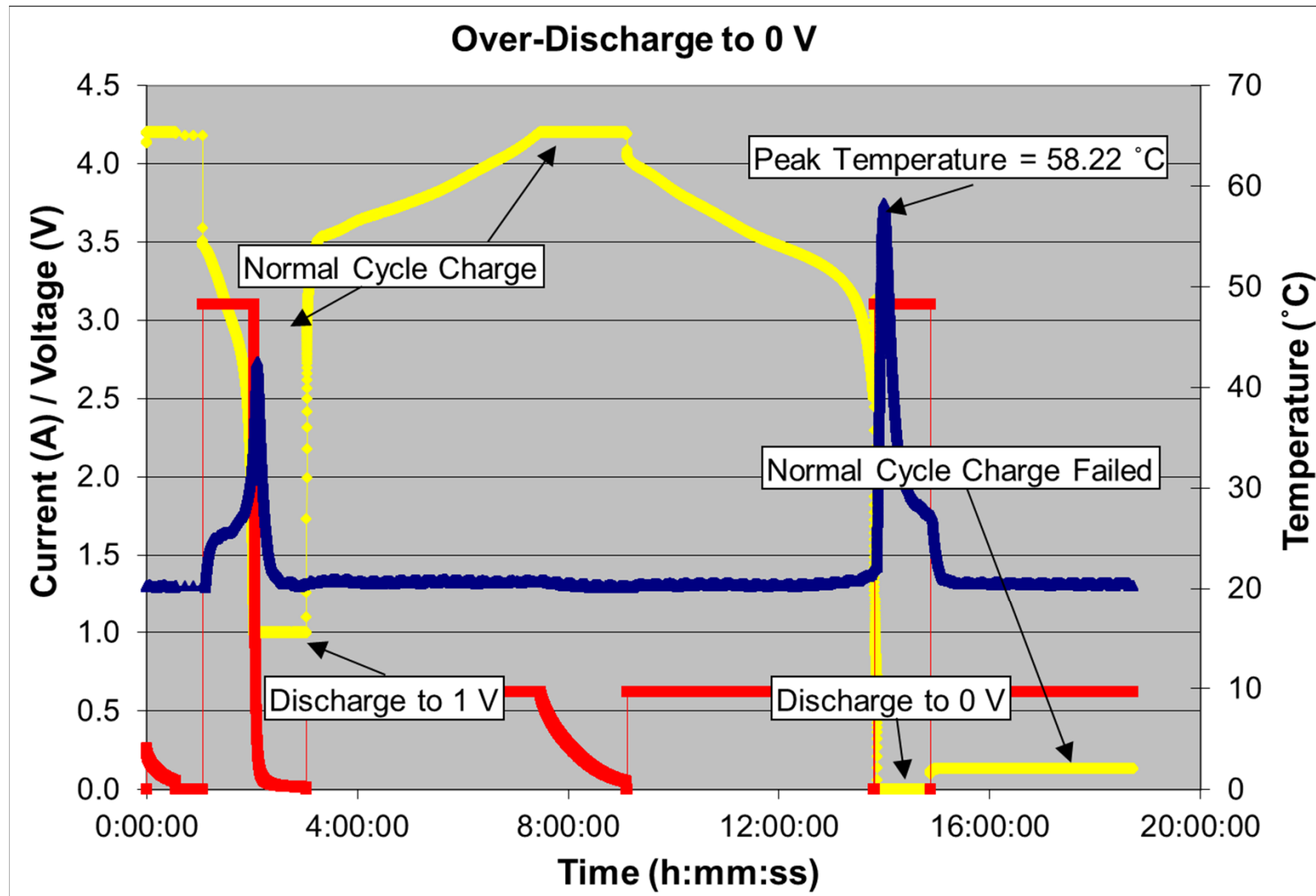
Panasonic 3.1 Ah Li-ion 18650 Cell



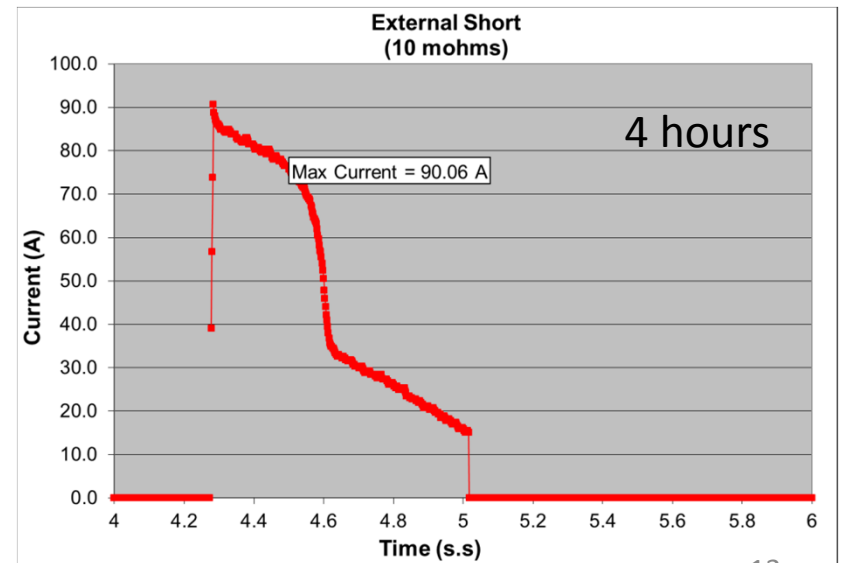
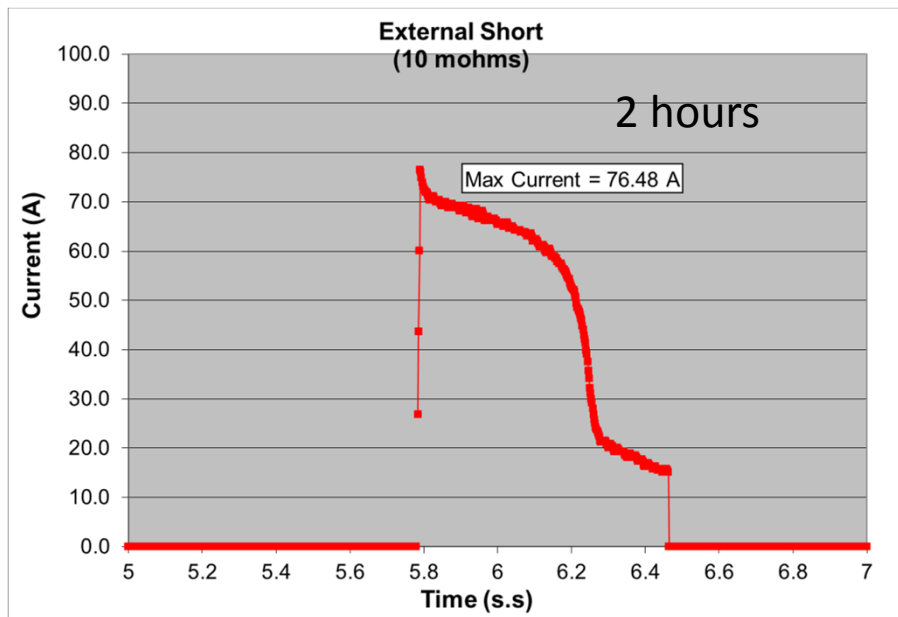
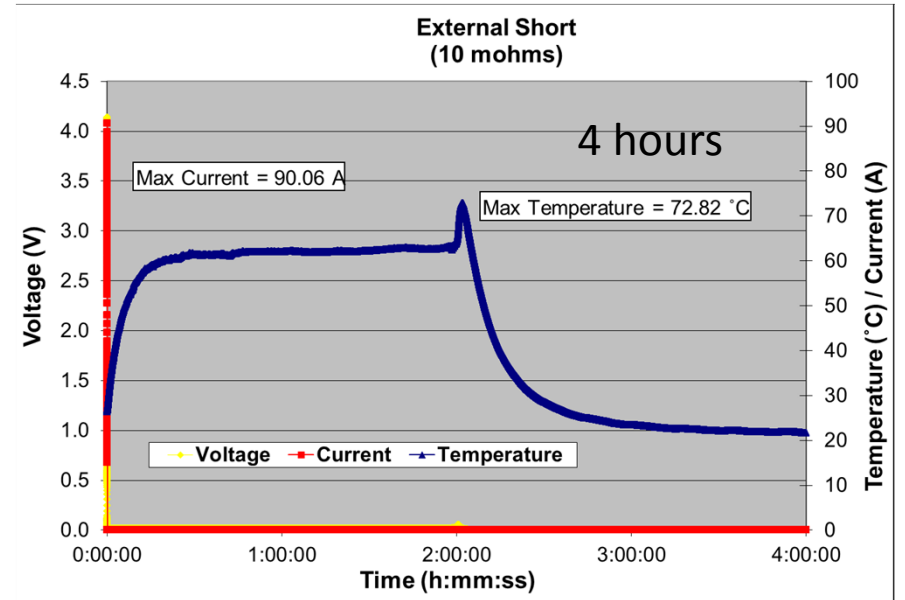
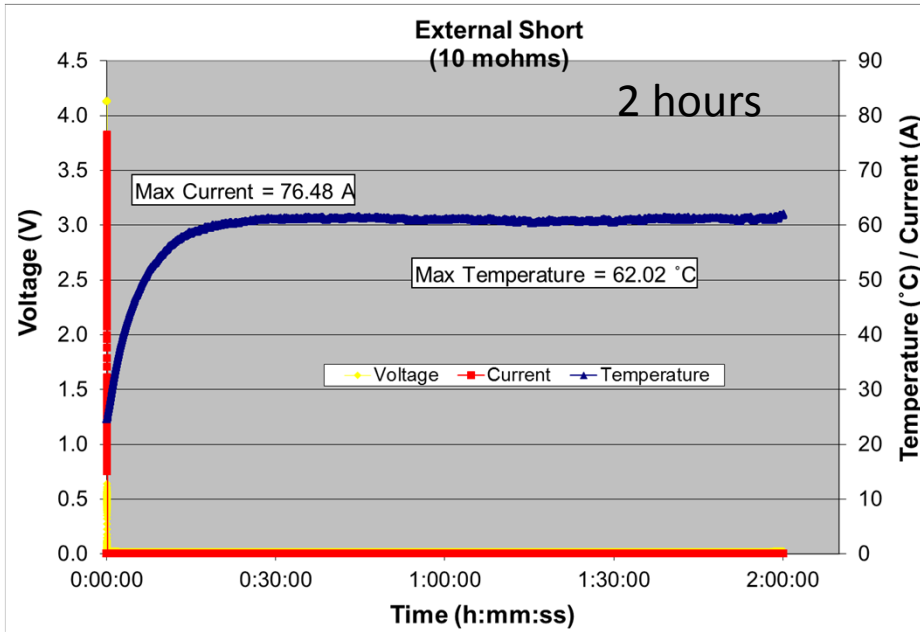
Panasonic 3.1 Ah 18650 Li-ion Cell



Panasonic 3.1 Ah Li-ion 18650 Cell

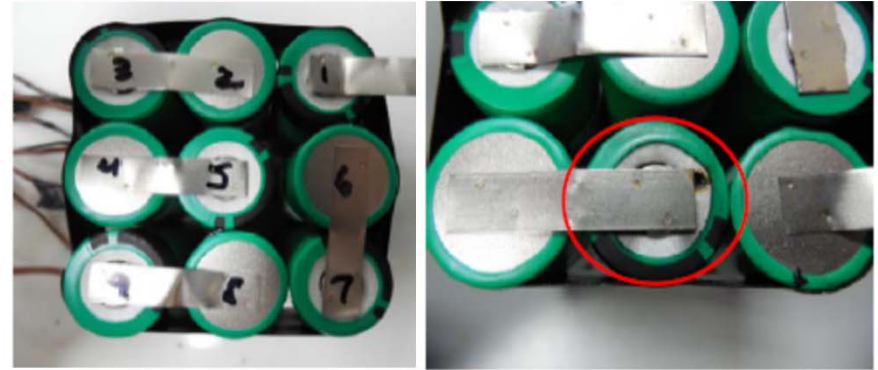


Panasonic 3.1 Ah Li-ion 18650 Cell



Panasonic 3.1 Ah Li-ion 18650 Cell

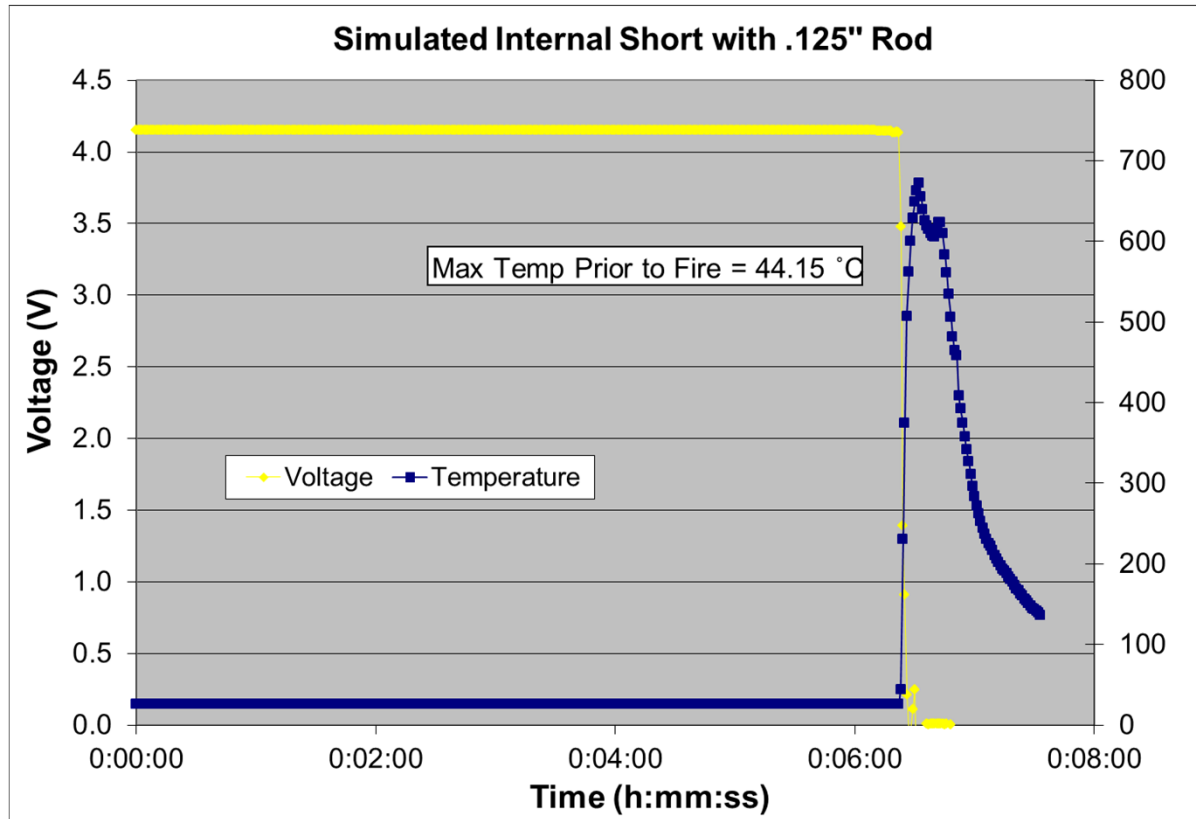
Series String External Short (10 mohms)



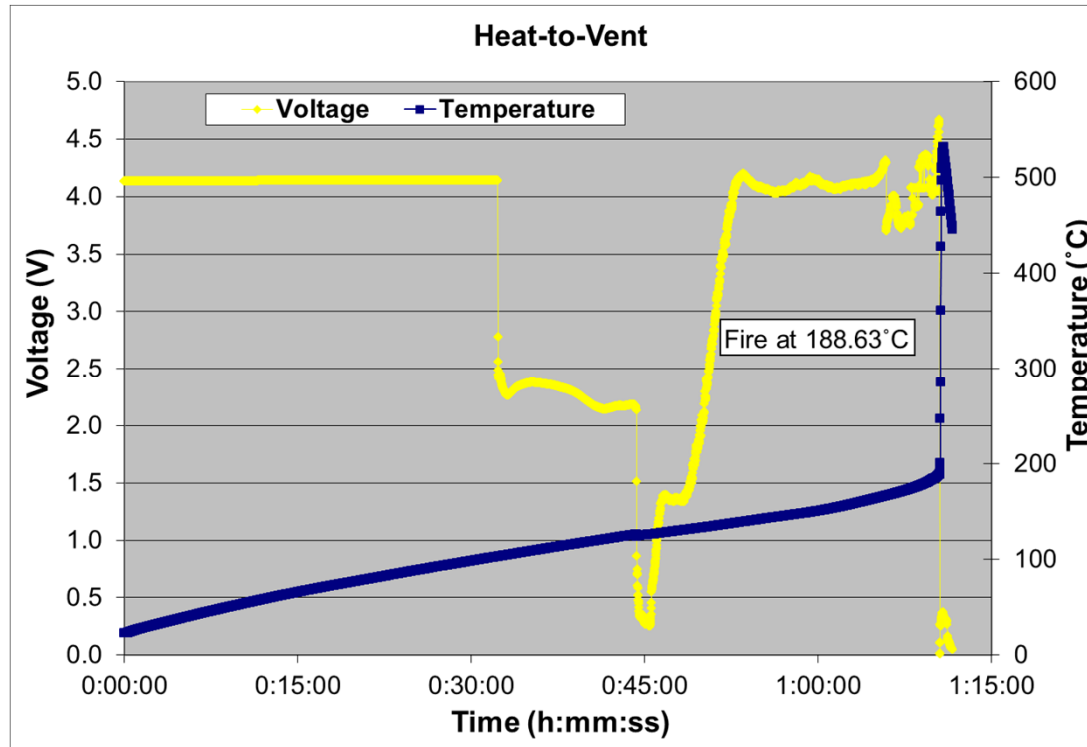
Cell #	Final Voltage (V)	External Resistance (mOhm)	Maximum Current (A)	Maximum Temp (°C)	Notes
1	4.05	-	-	23.57	No vent or fire
2	4.04	-	-	24.83	No vent or fire
3	4.05	-	-	26.43	Smoked, no fire, burn mark on cathode tab
4	4.04	-	-	24.84	No vent or fire
5	4.05	-	-	26.73	No vent or fire
6	4.05	-	-	37.68	No vent or fire
7	0.00	-	-	56.27	No vent or fire
8	4.05	-	-	38.36	No vent or fire
Overall	-	9.7	92.13	-	No vent or fire

Cell #	Final Voltage (V)	External Resistance (mOhm)	Maximum Current (A)	Maximum Temp (°C)	Notes
1	3.95	-	-	31.60	No vent or fire
2	3.95	-	-	32.73	No vent or fire
3	3.95	-	-	30.96	No vent or fire
4	3.95	-	-	31.04	No vent or fire
5	3.95	-	-	35.15	No vent or fire
6	3.94	-	-	42.42	No vent or fire
7	0.00	-	-	45.43	No vent or fire
8	3.94	-	-	38.63	Smoked, no fire, burn mark on cathode tab
9	3.95	-	-	31.12	No vent or fire
Overall	-	9.7	89.45	-	No vent or fire

Panasonic 3.1 Ah Li-ion 18650 Cell



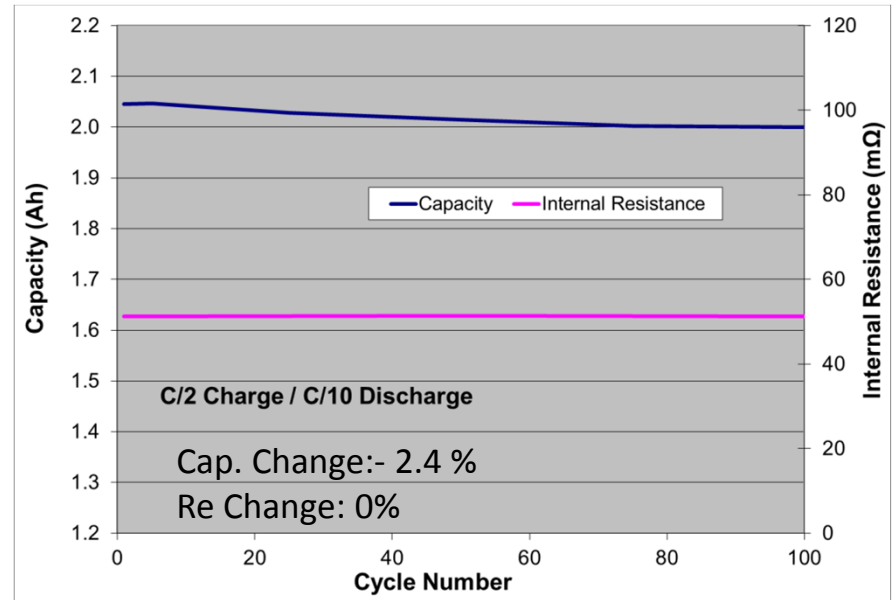
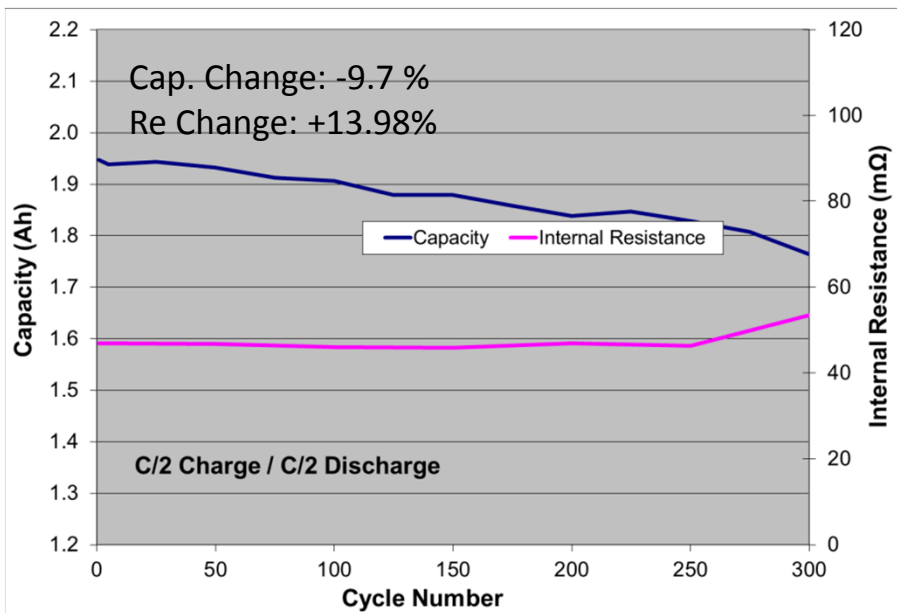
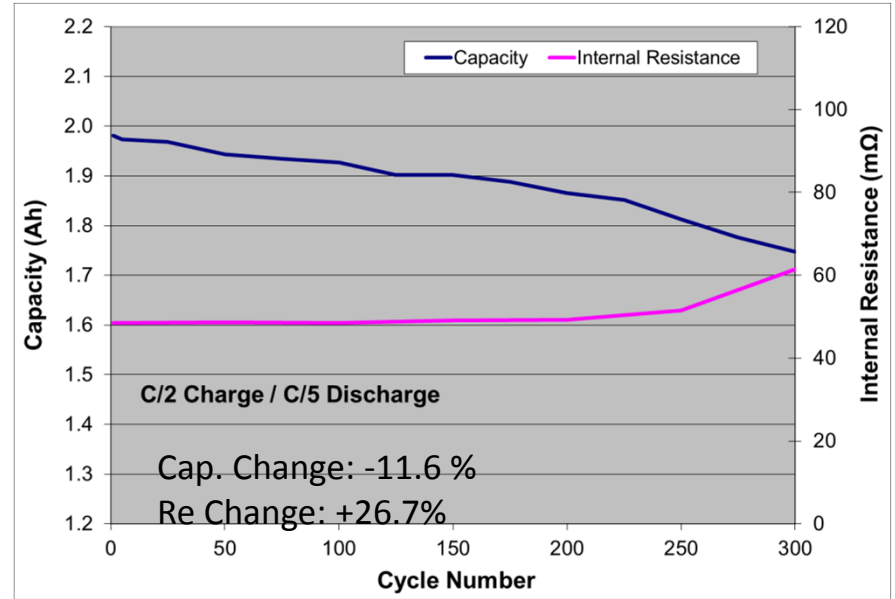
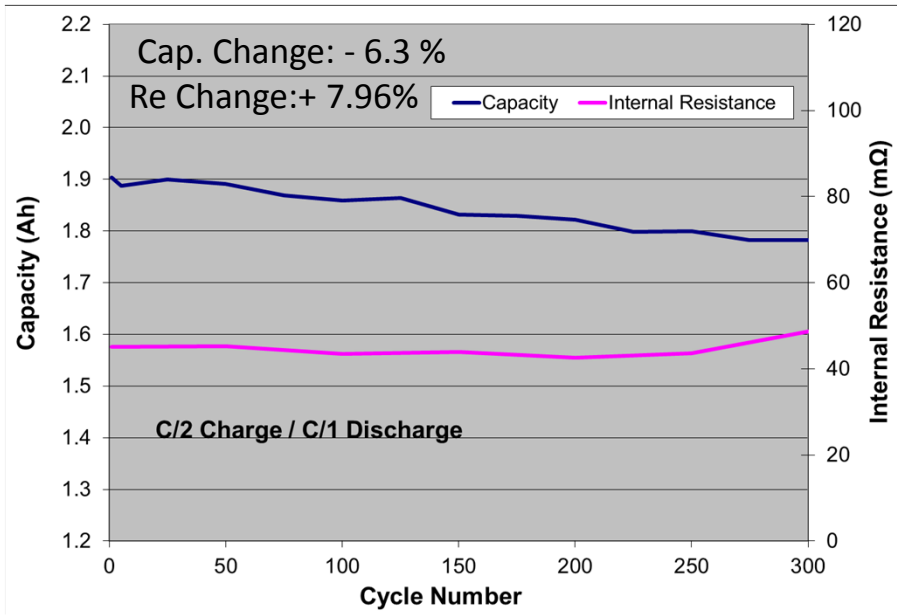
Panasonic 3.1 Ah Li-ion 18650 Cell



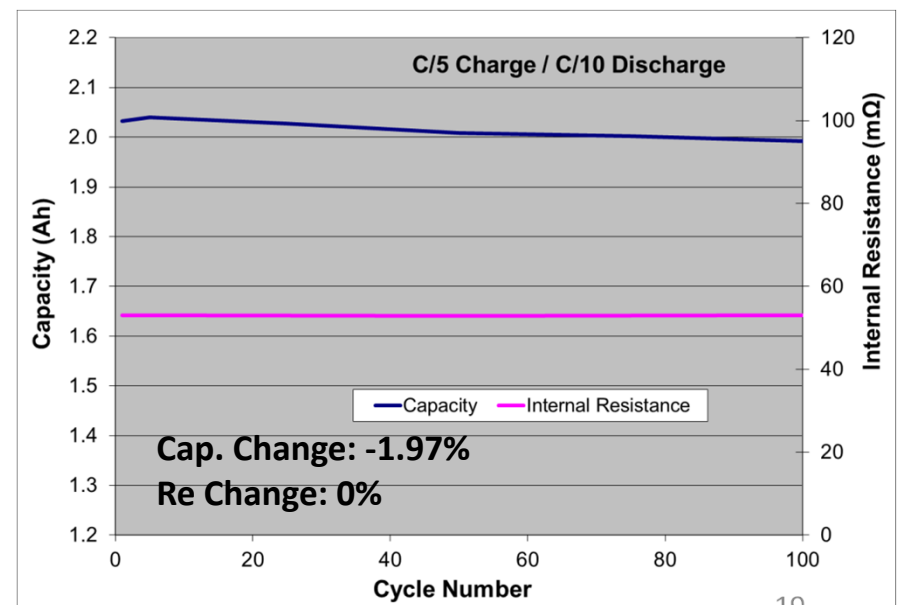
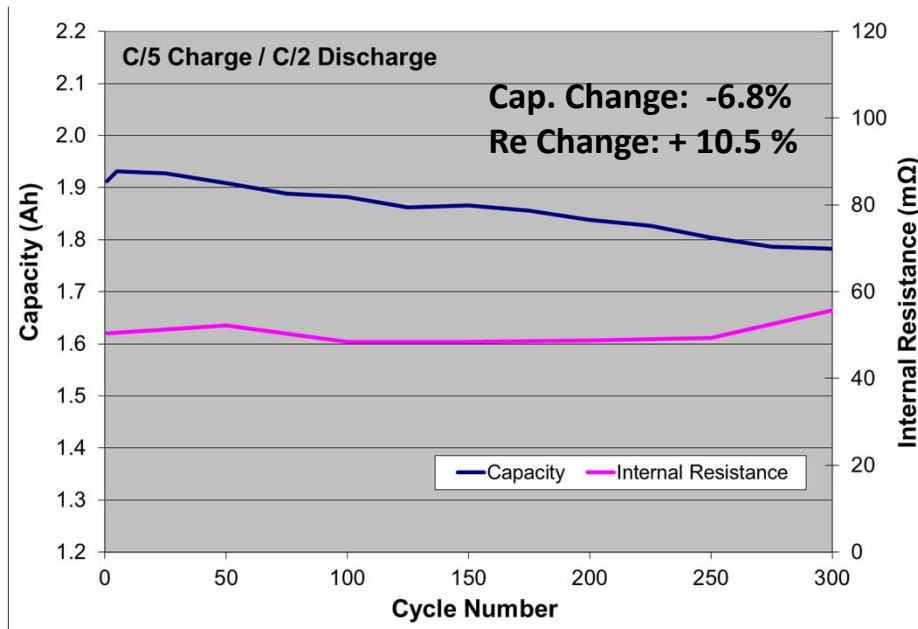
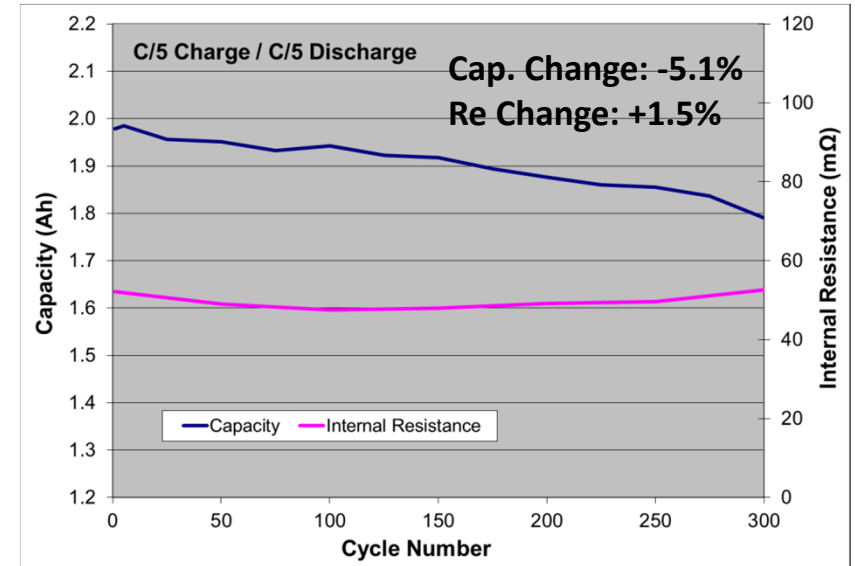
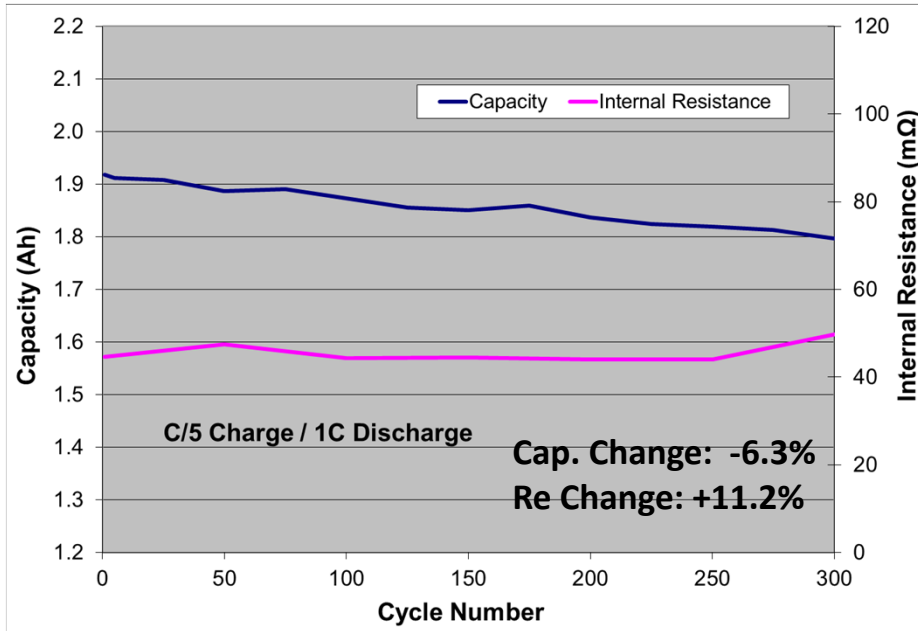
Moli STOBA 2.0 Ah Li-ion 18650 Cell

Performance and Safety Test Data

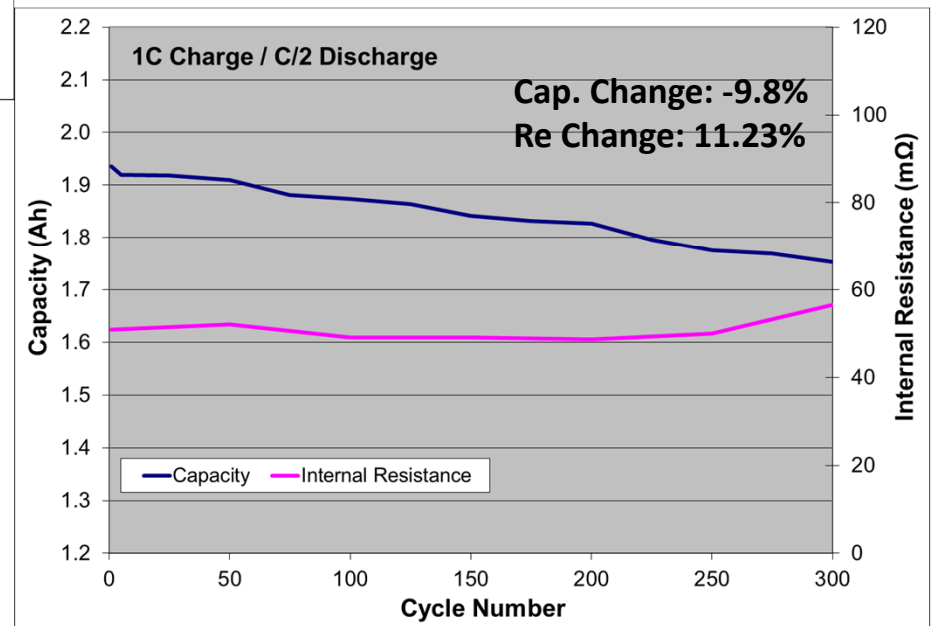
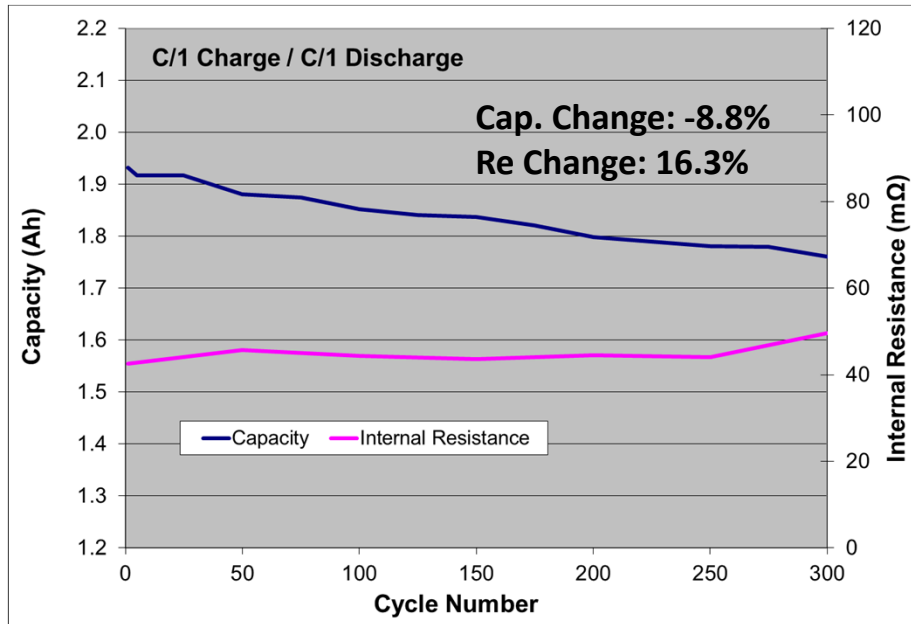
Moli STOBA 2.0 Ah Li-ion Cell



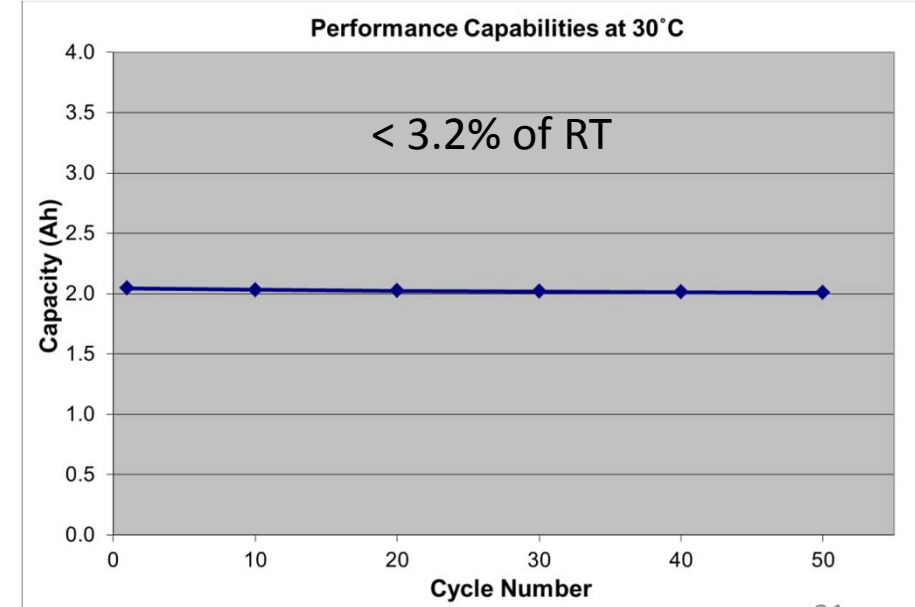
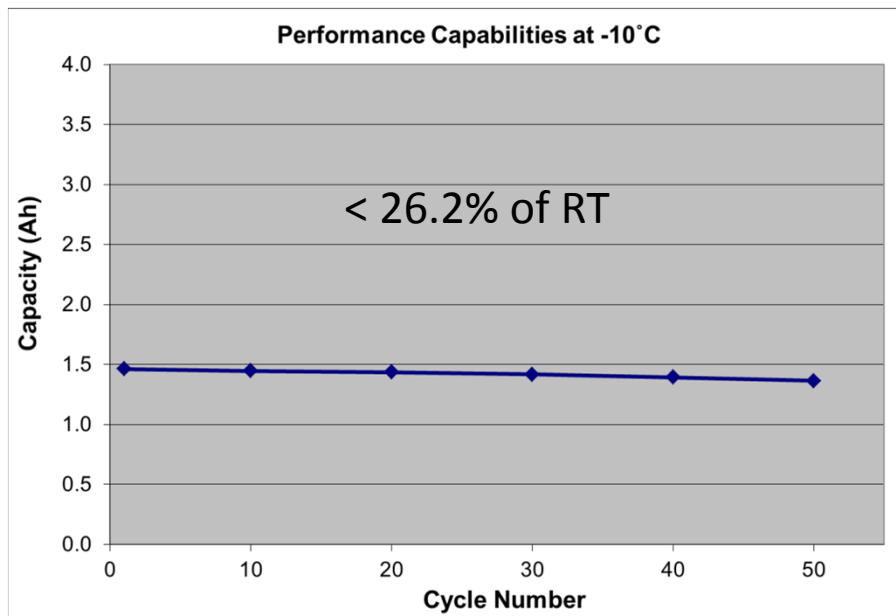
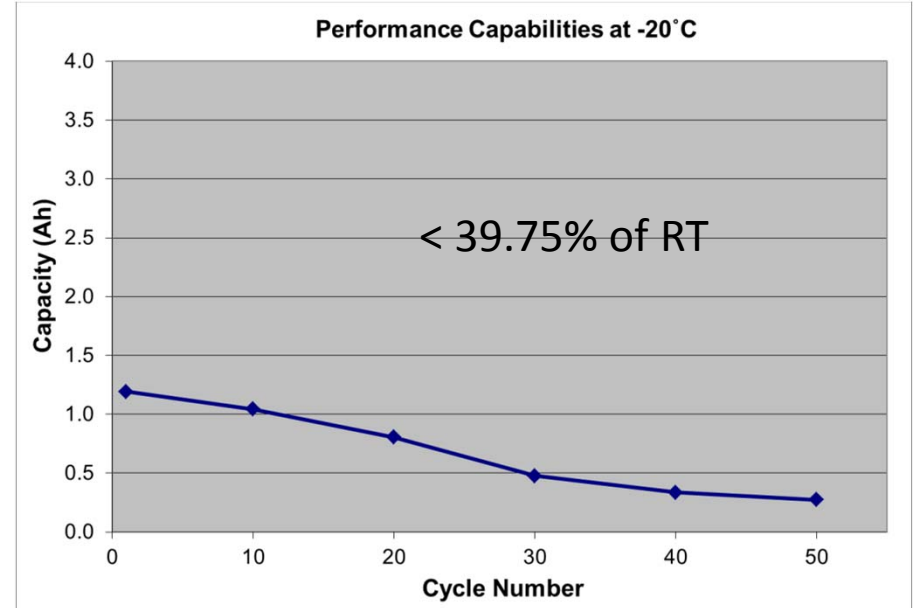
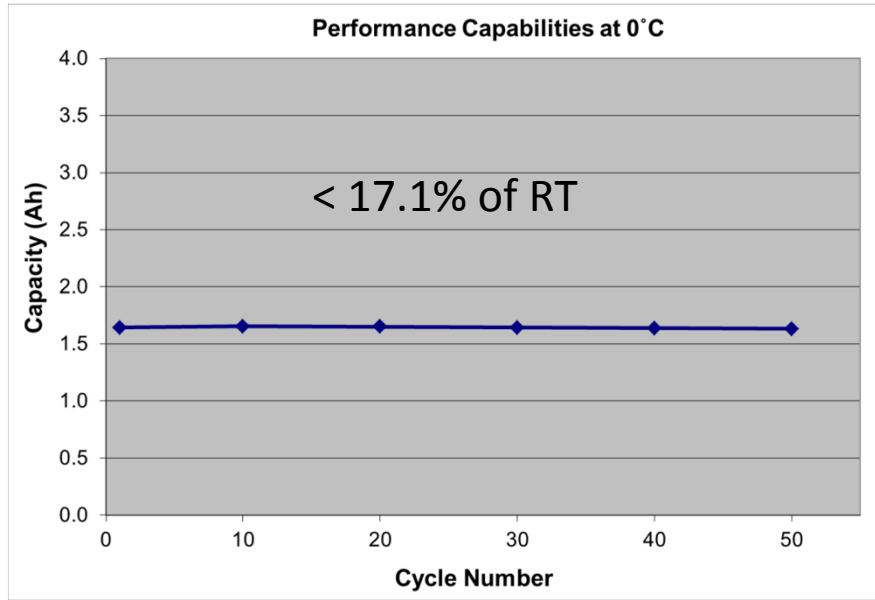
Moli STOBA 2.0 Ah Li-ion Cell



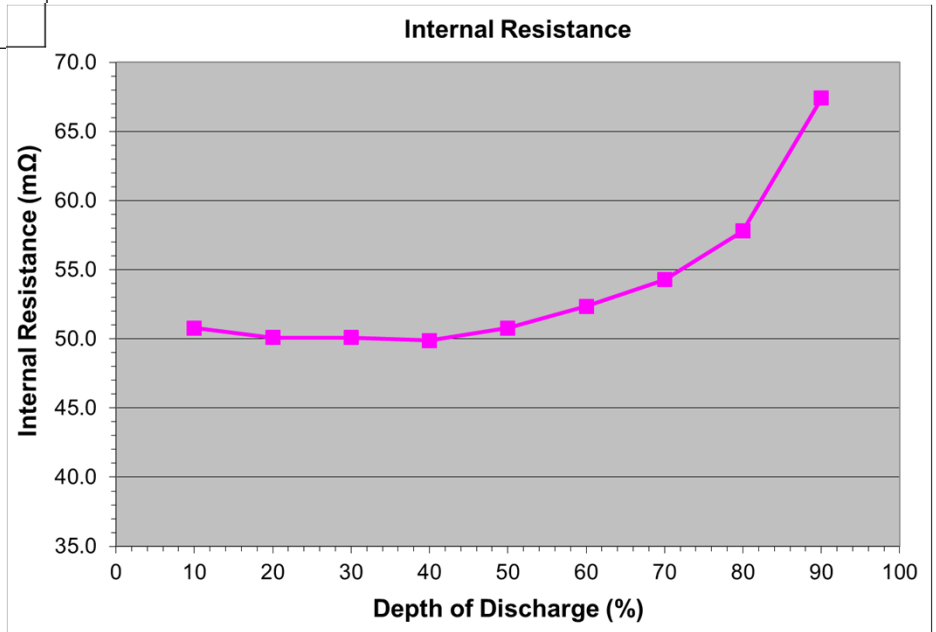
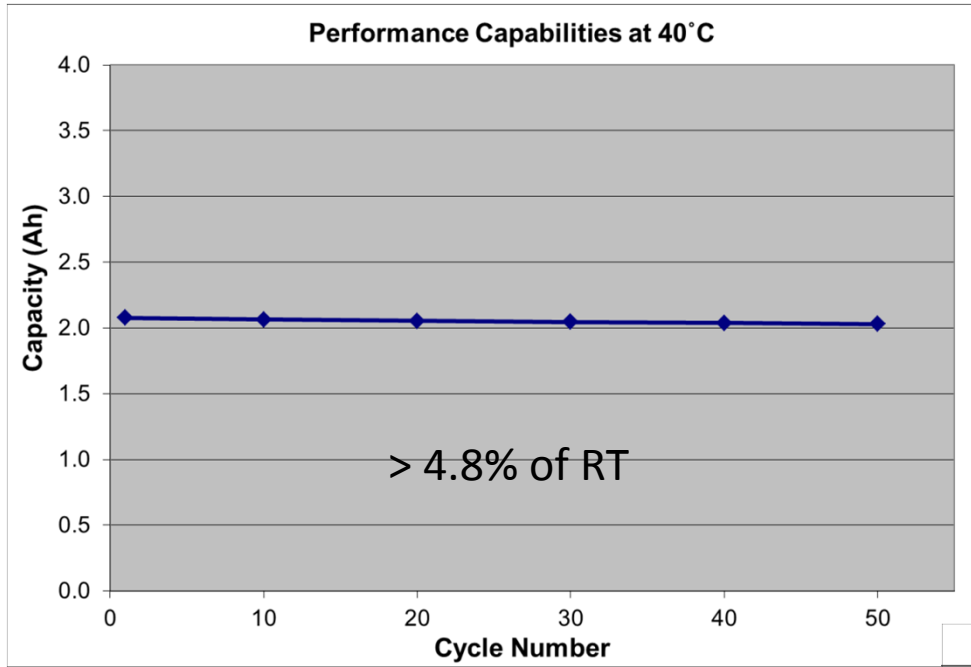
Moli STOBA 2.0 Ah Li-ion Cell



Moli STOBA 2.0 Ah Li-ion Cell



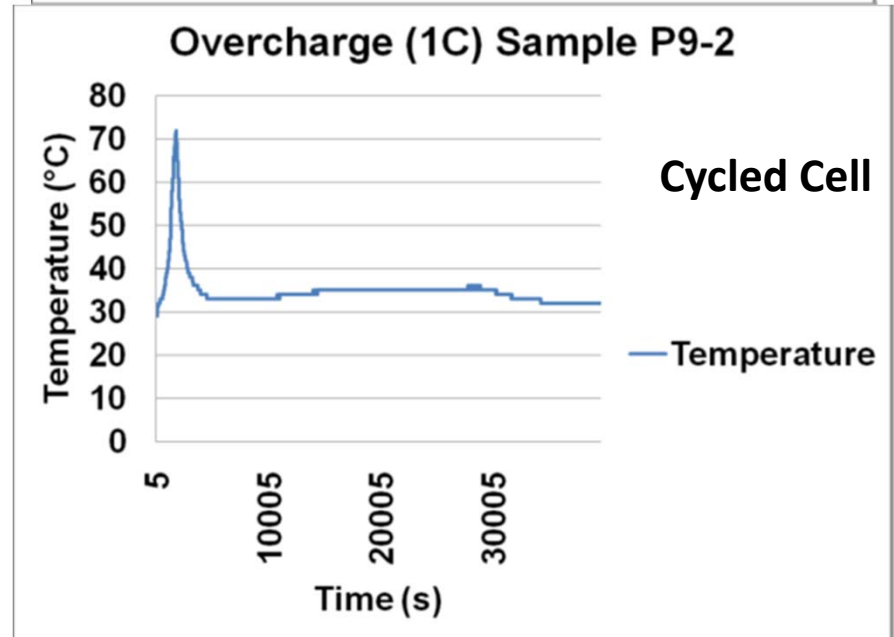
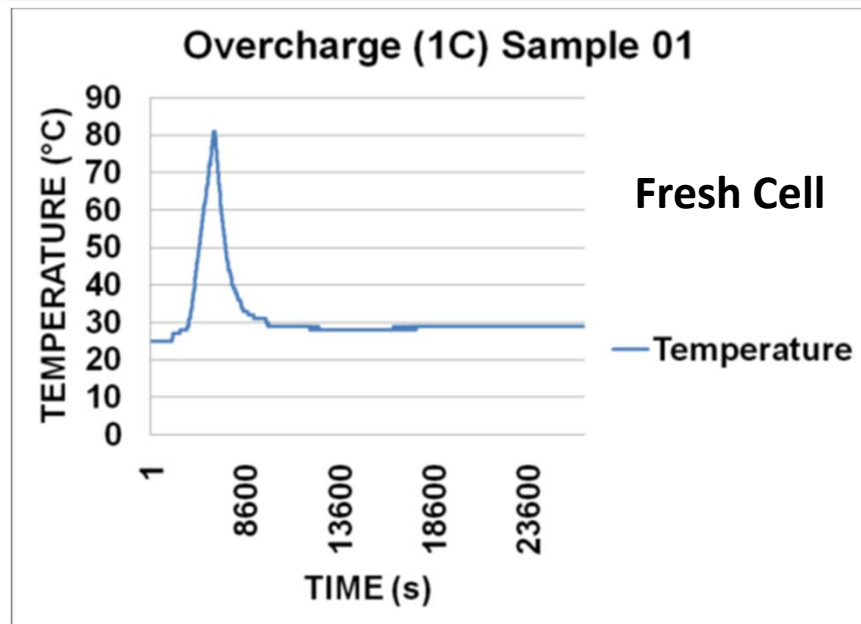
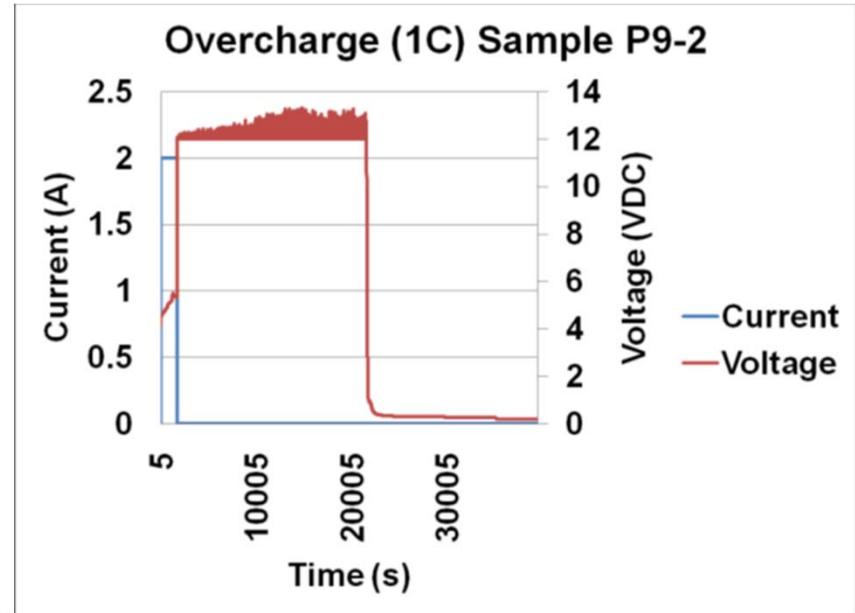
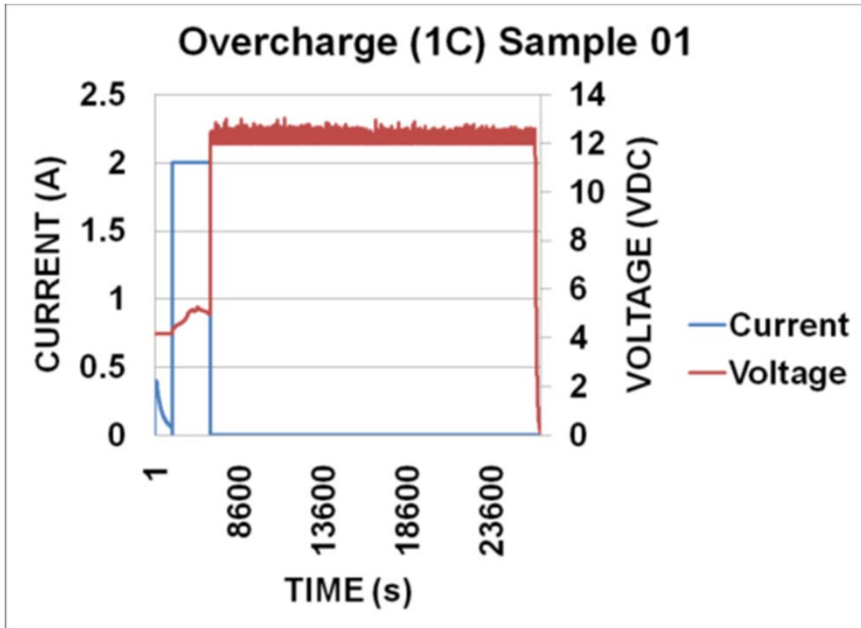
Moli STOBA 2.0 Ah Li-ion Cell



Moli STOBA 2.0 Ah Li-ion Cell

Fresh Cell

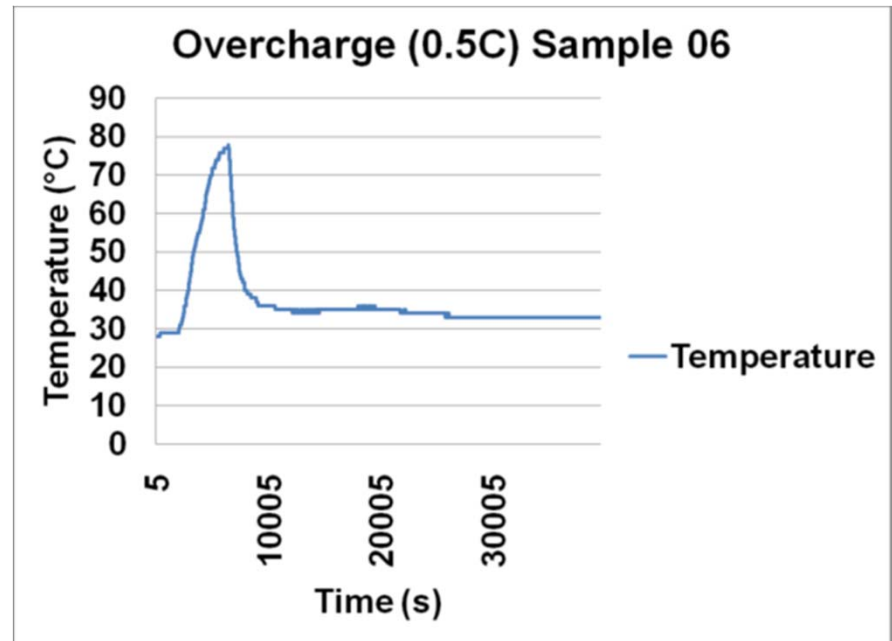
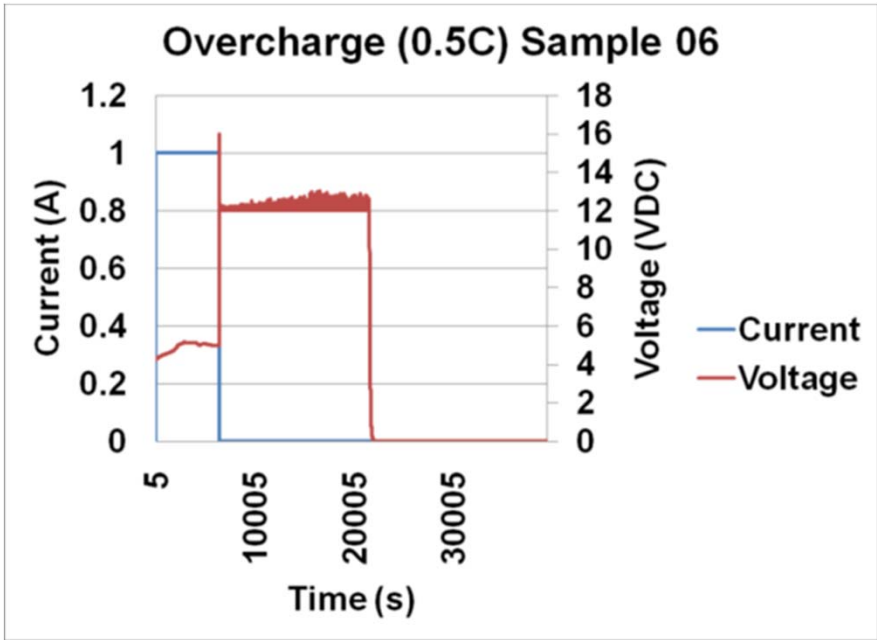
Cycled Cell



Fresh Cell

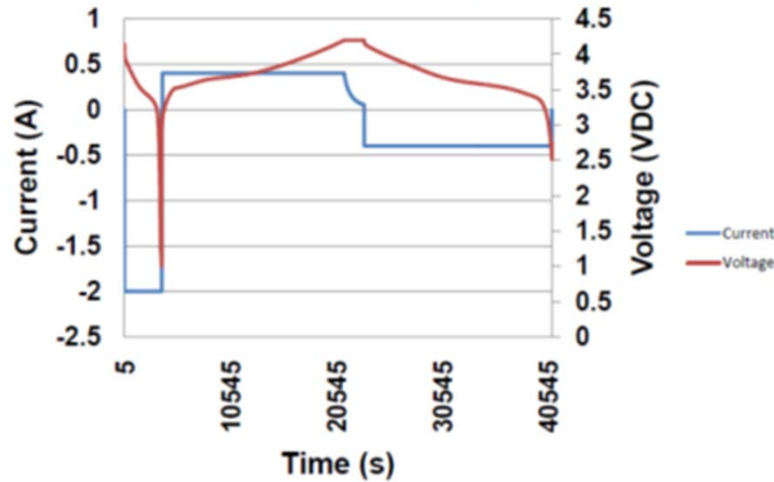
Cycled Cell

Moli STOBA 2.0 Ah Li-ion Cell

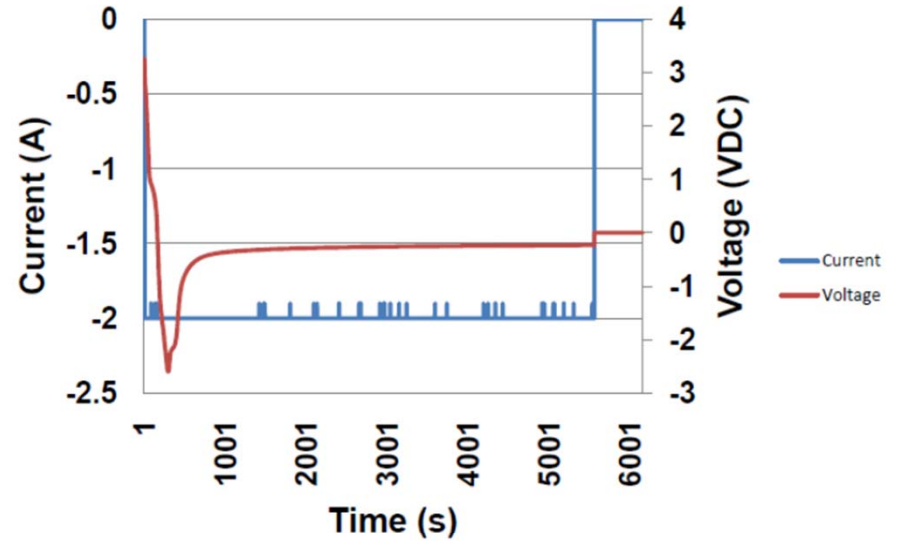


Moli ST0BA 2.0 Ah Li-ion Cell

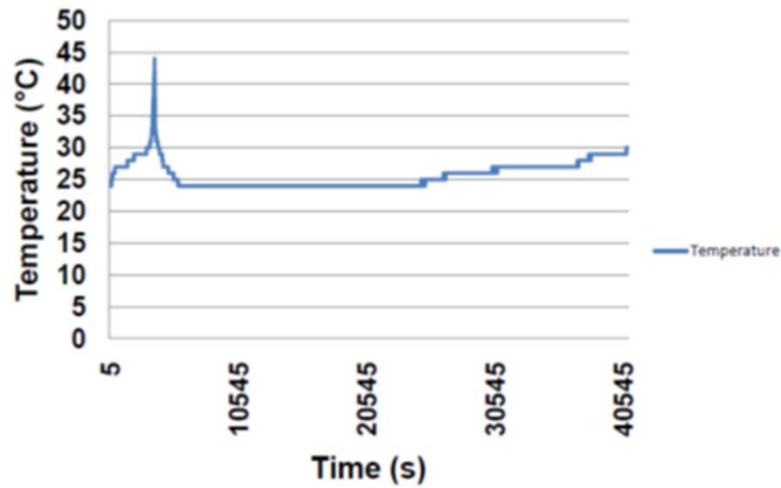
Overdischarge (Discharge to 1 VDC & Charge-Discharge Cycle) Sample 16



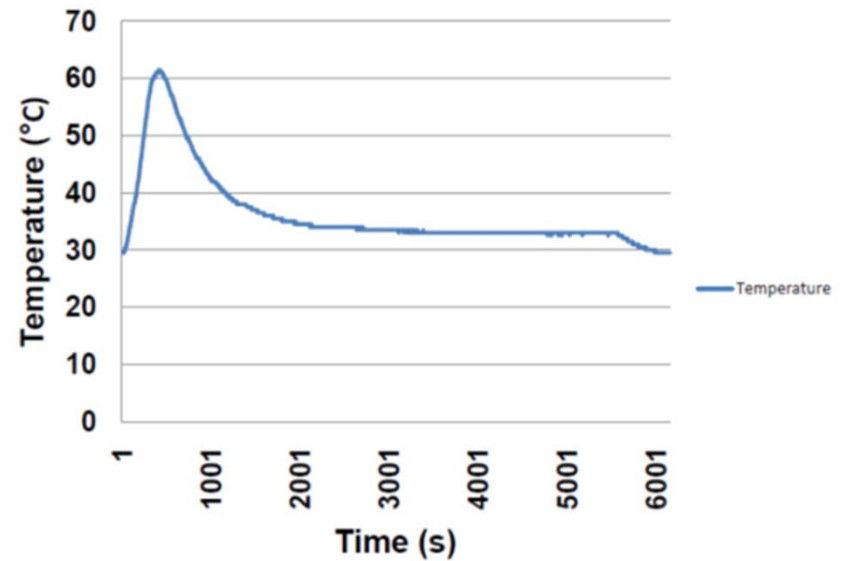
Overdischarge (Voltage Reversal) Sample 16



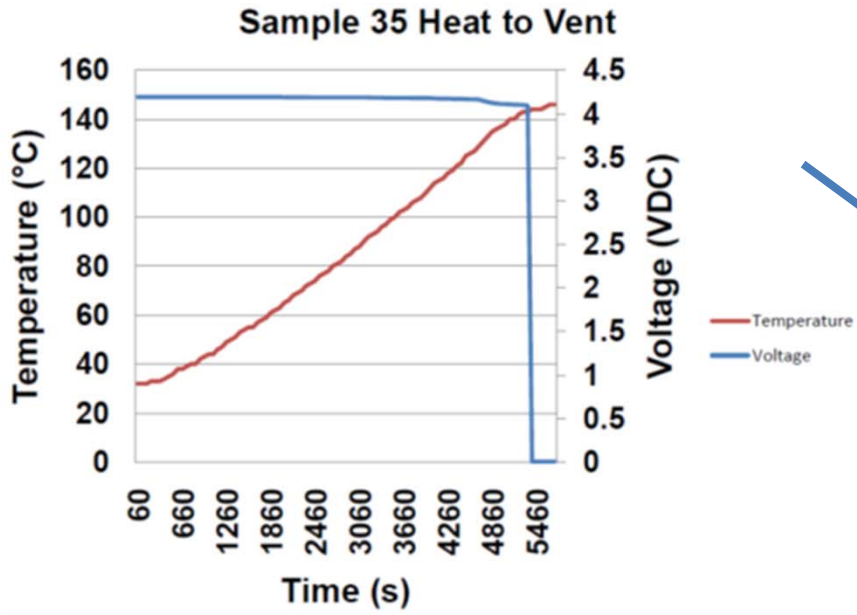
Overdischarge (Discharge to 1 VDC & Charge-Discharge Cycle) Sample 16



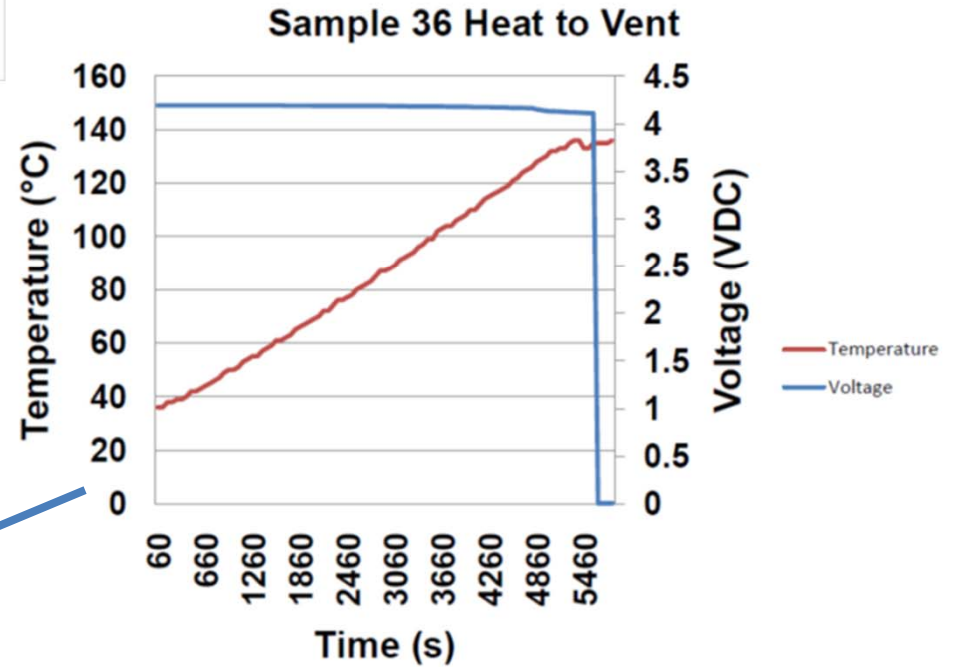
Overdischarge (Voltage Reversal) Sample 16



Moli STOBA 2.0 Ah Li-ion Cell



Temp Ramp Rate: 1.5 deg C/min.



Moli STOBA 2.0 Ah Li-ion Cell

Vent and Burst Pressure Test Data

Sample 14 vent opened at a pressure of 155 psi.

Sample 15 vent opened at a pressure of 145 psi.

Sample 10 burst at a pressure of 859 psi. Failure around crimp seal.

Sample 11 burst at a pressure of 645 psi. Failure around crimp seal.

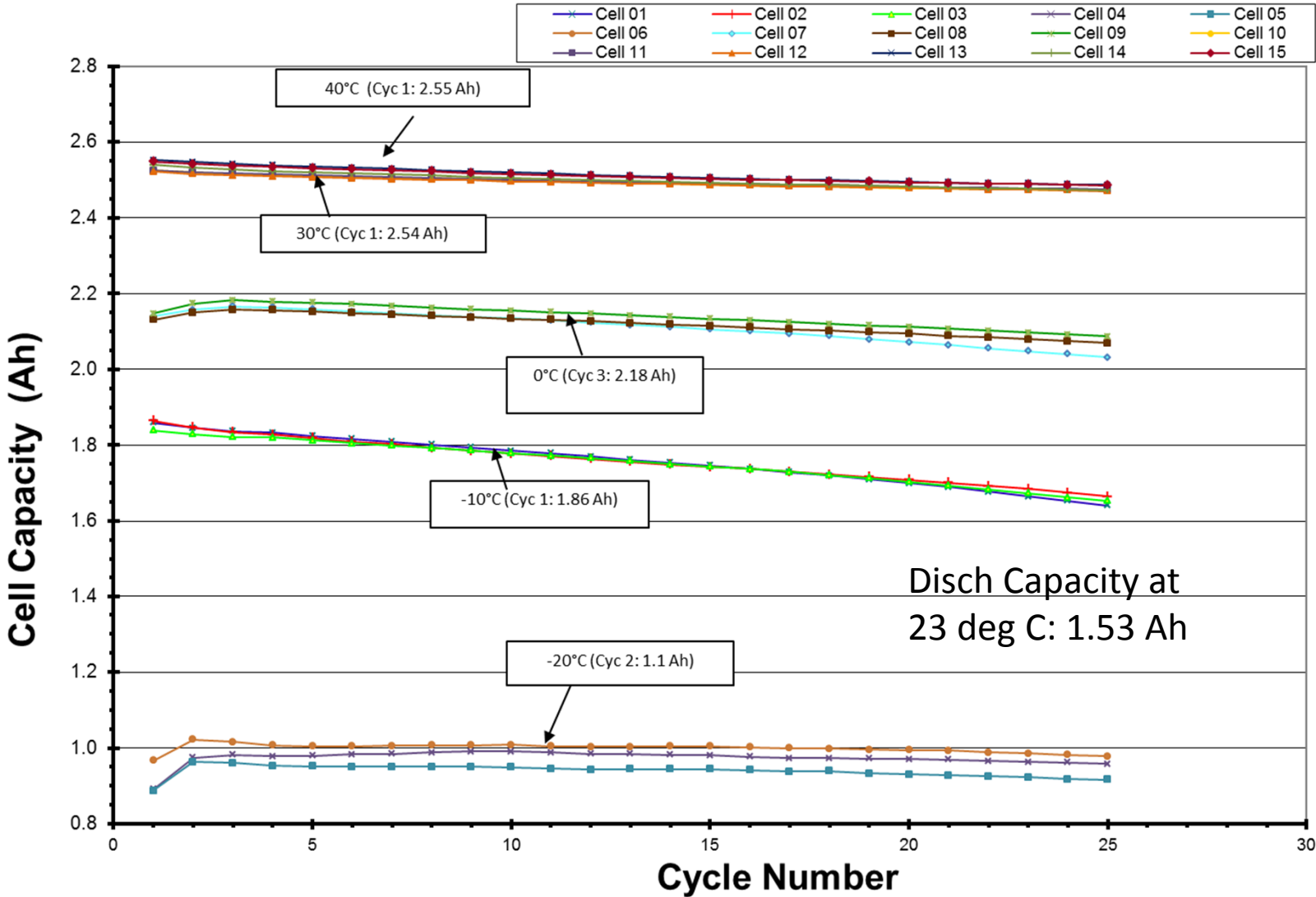


LG 2.8 Ah Li-ion 18650 Cell

Performance at Various Temperatures

LG 2.8 Ah Li-ion 18650 Cell

Charge at 1.40A to 4.2V, then 4.2V to 0.05A
 Discharge at 1.40A to 3.0V; Charge and Discharge at specified temperature



Acknowledgments

- PCTest Engineering
- Symmetry Resources Inc.
- Element Inc.